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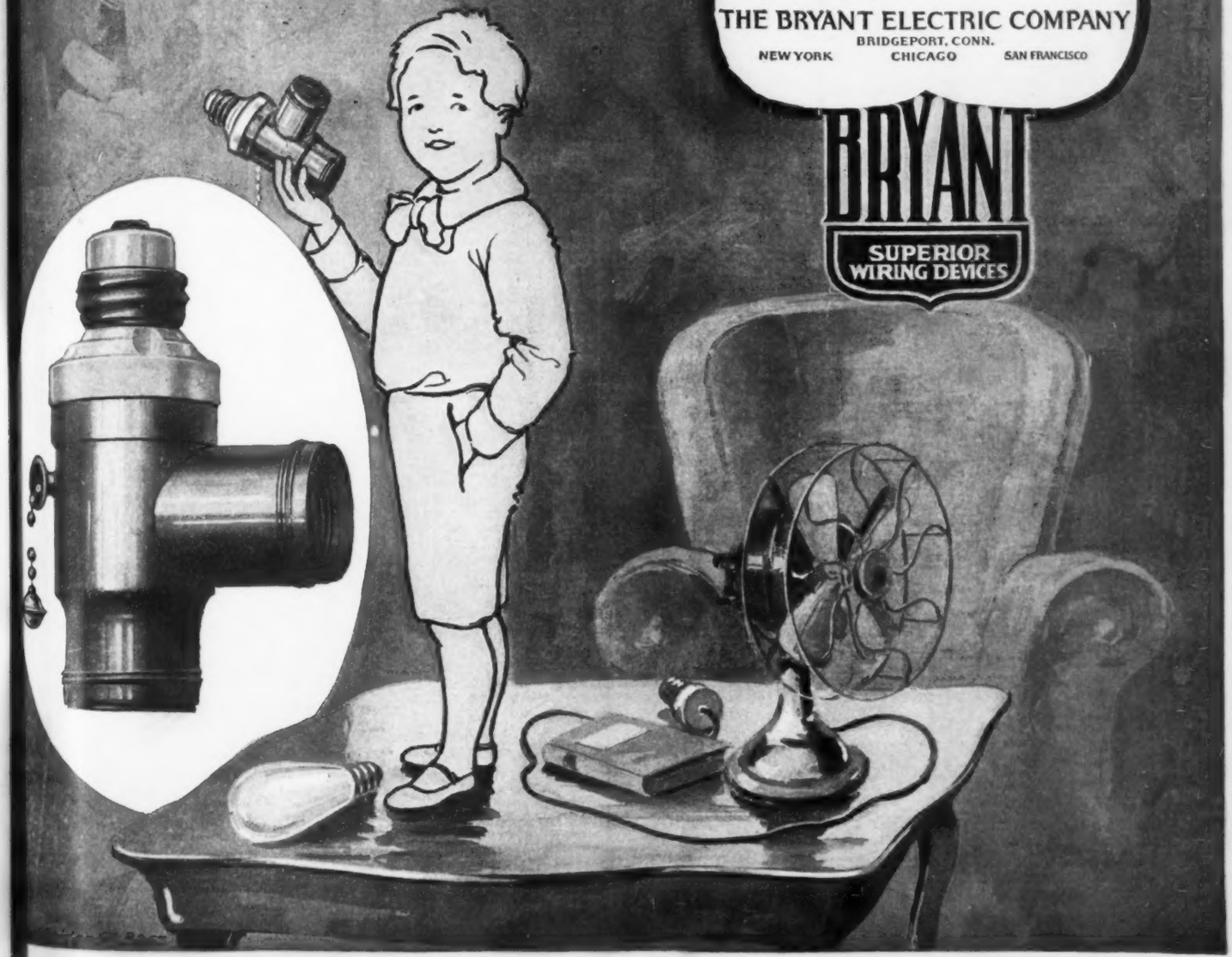

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Electrical World

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Western Spirit in N. E. L. A. Reports

TO THE central-station industry the Pasadena convention of the N. E. L. A. has contributed, among the other things that have always come from such meetings, one far-reaching influence. It has recorded and made available an interpretation of the spirit of the West in a language filled with evidences of opportunity and development which the engineer, the central-station executive and the financier interested in the welfare of the central-station business can understand. This year many of the vital reports have been compiled by Western engineers and commercial men, and in these reports they have not only painted the pictures of work done and to do but have given fundamental facts on which this work has been based and must in the future be based if electric service is to extend farther and farther into the fertile regions hardly explored in that great empire west of the Rockies. In the address of President Ballard and the reports of the public policy committee, the water-power development committee and others which were presented in the ELECTRICAL WORLD last week, and in the discussions on reports of some of the technical and commercial committees that are presented in this issue, there is a Western viewpoint that will be inspiring to central-station men in other sections of the country. S. M. Kennedy's ideals of service and A. Emory Wishon's self-interest plan applied to utility financing have made an indelible impression. A wide application of the principles involved will go a long way in helping the public to realize that the central station is a community builder as well as a public servant.

The Washington Conference

ONE hundred thousand engineers and forty-four engineering bodies are to be represented at the organizing conference of technical societies which will meet in Washington next week. Such widespread participation in the meeting is ample testimony to the potency of the idea that underlies it. That idea we take to be the very simple and human one that it is time for the engineer to assert himself in a way for which the technical associations do not provide. Class segregation is foreign to the spirit of American institutions, but none the less there exists a field of service—social, political, nationally constructive, broadly intellectual—in which an enlightened self-interest impels every considerable body of men to take a collective part. The engineers of America have long been a considerable body of men, but never yet have they taken such a part. If by the comparison of views and the thrashing out of differences the Washington conference can remodel any existing body—and there are two that afford the opportunity—or call into being a new one to meet the need, thus providing engineers both with a means for exercising a beneficent influence on the current of public opinion and with an aid to legitimate self-advancement, from it an epoch in the annals of engineering will date. Whether such a body shall be founded on the plan of individual, voluntary membership or on membership entailed automatically by the fact of belonging to a technical society is a non-essential which the conference or those whom it represents must work out. What is essential is that the new body, if it shall be born, shall have behind it a united army in which the wisdom of the veterans, the strength of the seasoned troops and the enthusiasm of the recruits shall combine to make an invincible esprit de corps, with unselfish public service the great object in view.

Electrical Price Policy

PRICE policies in the electrical industry have not kept pace with the growing importance of the electrical business among the fundamental industries of the country. No doubt this is partly due to the fact that every electrical man is imbued with the belief that electricity must always do things cheaply. This is not quite true. There are cases where cost is a secondary consideration and quality of results is primary. Moreover, in the electrical industry the men who make the prices are the salesmen of the business, who more often represent the point of view of their customers than the viewpoint of their own company. This has been one of the factors that have kept the electrical industry practically free from profiteers in the recent scramble to "boost" prices. To that extent the system is commendable. However, if business is now to enter on a period of narrower margins of profit, as many think it will, a change in methods of determining and quoting prices seems necessary so that the man who makes the sales will be able to maintain and stimulate a demand for goods of high quality.

Emmet as an Engineer

AS AN engineer William LeRoy Emmet, to whom the Edison medal was awarded last week for achievements in invention and developments in electrical apparatus and prime movers, as reported elsewhere in this issue, represents a rare type to whom the electrical industry owes much. For thirty-three years he has worked earnestly and enthusiastically toward one end, the mastery of the obstacles that lie between engineering theory and its practical application. In this work he has shown tenacity and fearlessness, his inward conviction of success and his practical knowledge of operating conditions enabling him to weather discouragement. Apparent failure in principle only led Emmet to study details, for in his fullness of knowledge of these details he has perfected the fundamentals. In the analysis of

faults, mechanical and human, Mr. Emmet is a master worker. Although said to have been a dull student as a boy, he has through untiring energy and diligent application of his faculties not only overcome such a handicap, if it did exist, but injected into engineering thinking methods that will bear close study and extensive imitation. To offers of large salaries and positions of executive importance such as men of lesser ability have succumbed to Mr. Emmet turned a deaf ear, preferring to remain in the depths of unsounded engineering problems rather than assume the direction of more certain and better explored endeavors. Mr. Emmet has never been an investigator on paper, but as an observer and analyzer of deficiencies of design he has, like a great physician, diagnosed troubles where others have failed; and in this work he has never shown the slightest fear in departing from regular practice. His present work on the mercury-vapor turbine is an example which promises to revolutionize steam-electric plant practice with economies beyond the fondest dreams of his co-workers in this field.

Economies Through Standardization

THROUGH all the trying experiences of the last year or two central stations have maintained a remarkably high grade of service. This is, of course, the chief function of the utilities, and the character of service must be jealously guarded. Most of the companies, however, are facing a most serious problem in financing sorely needed additions and maintenance construction work. The danger lurking in this state of affairs is dwelt upon by the electrical apparatus committee of the National Electric Light Association, whose report is abstracted rather fully in this issue. The situation must be brought to the attention of regulatory commissions so forcefully that no one shall misunderstand the necessity for relief measures. In the meantime every effort should be made to guard the good name of central-station service.

The committee urges the importance of standardization of such a nature that it will not interfere with progress. This matter is of particular importance in these days of high prices, and the success which has already been attained by the elimination of unnecessary transformer ratings is worthy of careful consideration. Manufacturers say that transformer price increases would have been 30 to 40 per cent greater had the standards not been adopted.

Of timely interest is that part of the report devoted to automatic operation. While considerable information is available showing the economy of automatic operation in electric railway practice, central stations have not adopted it extensively. The cost of manual operation, however, has risen to such a degree that central stations should now consider fully the possibility of automatic and remote-control apparatus for their systems. The committee reports that 500-kw. automatic motor-generator substations are soon to be installed both in a three-wire direct-current system and in an industrial plant. Small automatic hydro-electric plants are also being built and data should soon be available concerning their operation. Details of some of these were presented in the Feb. 28 and April 10 issues of the ELECTRICAL WORLD, pages 477 and 827.

An important activity of the committee has been the consideration of the proposed National Safety Code in co-operation with the Bureau of Standards. Apparently there has not been full agreement in the matter of the fire hazard of oil-filled apparatus. There does not appear to be evidence that the hazard is great, but the subject needs further investigation in order that the operating companies shall not be unnecessarily hampered by drastic commission rules.

On the plan of subdividing its membership geographically, which was instituted this year, the committee reports favorably. This plan resulted in fuller participation in committee activities by the forty-five individual members.

Findings of N. E. L. A. Prime-Mover Committee

ONE of the technical events of the year now generally recognized among central-station engineers is the presentation of the report of the National Electric Light Association's committee on prime movers. No other committee keeps in better and closer touch with the developments of its subject or furnishes a greater volume of practical information. The work of the committee this year does not fall behind that of its predecessors. Its study of the steam turbine is perhaps the most important part of its task. As turbines have steadily increased in output they have gained in efficiency, but at the cost of constructional difficulties of no insignificant order. At the present moment the committee believes that about 30,000 kw. is the maximum size to be considered at all standard for single-shaft machines, although a single unit 50 per cent above this capacity is now in operation. For greater outputs practice is tending toward compound turbo-generators in which the total stages of expansion are divided between two or more mechanical units linked only electrically.

Just what the final economic relation is between such a combined unit and several single-shaft machines of the same aggregate output remains yet to be seen. The tests of some of the compound generators look remarkably well, but it is not yet clear whether in practical operation there is any real gain or whether the test conditions are equally favorable to the things compared. Whether, let us say, 60,000 kw. in one composite unit or two independent ones gives the better mechanical condition is still uncertain, for in fact it is the mechanical problems in these large outputs which really are grave matters for concern. There have been several serious failures in large units, due in the main to vibration of the wheel structure already worked at high stress and eventually yielding to fatigue. At the high speeds and stresses in use dynamic balancing becomes increasingly necessary and may have an important bearing on safe operation. Incidentally it is subject for congratulation that the engineering division of the National Research Council is taking up the matter of fatigue of metals to improve conditions in their use.

Another phase of the committee's investigations deals with the condenser. It is pointed out that the education of station operators in the proper handling of condensers and auxiliary apparatus and in the analysis of their performance is a matter too important to be overlooked. It is just here that care may actually determine the economical operation of the plant. There is a limit with any given turbine design to the vacuum which can be advantageously used, while up to this limit there is material gain, so that turbine and condenser cannot be

considered apart but must be regarded as a thermodynamic unit. An interesting sidelight on condenser difficulties is shown in a brief report to the committee regarding the resistance of condenser tubes to corrosion, bearing particularly on the structure of the metal as related to its final endurance.

On the other side of the turbo-generator lie the boilers with economizers and superheaters, and at the extreme end of the line are the furnaces and their feeding apparatus. The tendency toward large boilers, long delayed in this country, has been rapidly increasing of late, so that units of 1,000 and 1,500 nominal horsepower or even larger are becoming common. Pressures, too, have increased, but since the last report there is little to add in the way of experimentation. It must be agreed that boilers and turbines can be developed for much higher pressures than those now in use. The limitation seems to come from final temperature rather than pressure, and this limit probably lies below 800 deg. Fahr. as the result of both pressure and temperature. The difficulties of the higher pressures lie perhaps more in the piping and auxiliaries than in the boilers and turbines, and how the effect of this limitation will bear on the distribution of temperature as between superheat and pressure is altogether indeterminate. At present the tendency seems not to be over 250 lb. and 300 lb. per square inch (17.5 kg. to 21 kg. per sq.cm.) as to pressures and to build up the rest of the safe temperature for superheating.

One important feature noted in the committee's report is that on the whole superheaters give a remarkably small amount of trouble, which is an encouragement to their more extensive use. The whole question of their employment is that of the most economical source for the heat necessary to push the feed water to its final temperature. At present practice varies widely, running all the way from depending wholly on available exhaust for feed-water heating to extensive use of economizers helped out by what exhaust may be available.

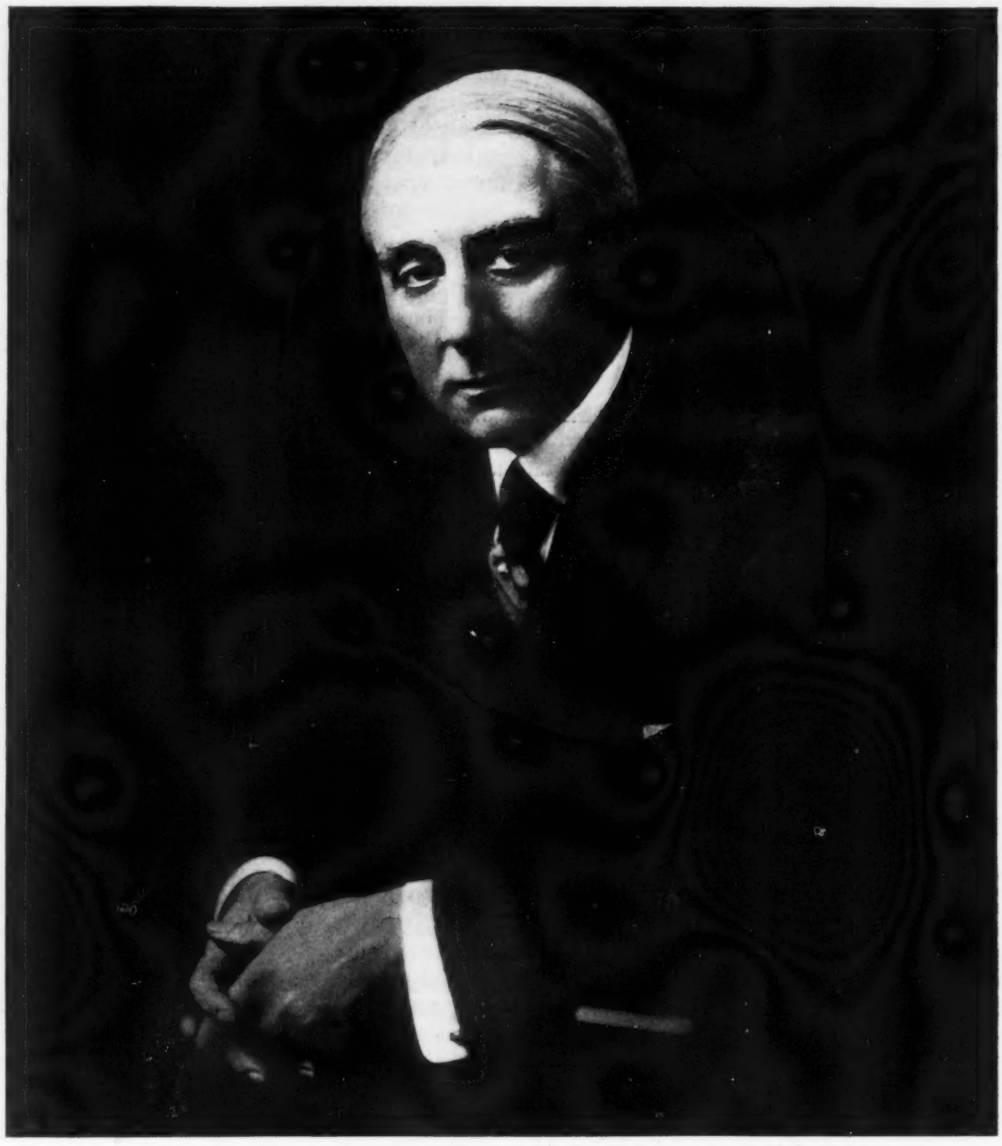
Returning to the furnaces, there has not been much to be added with respect to the ordinary stoking devices handling good fuel. There has been much progress, as we have often indicated in these columns, in the burning of low-grade coals and lignite. With proper furnaces and stokers, both chain-grate and underfeed, good boiler efficiencies have been maintained with a decidedly mean quality of fuel running between a little over 7,000 B.t.u. and a little over 9,000 B.t.u. per pound. In the present state of fuel supply these data are important. The day has passed when one can figure on the use of first-class steam coal as general practice. As a corollary to this subject the use of pulverized fuel is beginning to assume considerable importance. Powdered coal in quantity has been successfully piped a distance as great as 2,000 ft. (600 m.) from the powdering plant, but the present tendency is to powder on the spot. Where this is done the boiler plant is pushed fully up to its normal efficiency and the utilization of the fuel is excellent. Just how far the process can be made available will in the long run depend on its bearing on the use of low-grade fuel, a subject which has not yet been thoroughly worked out, although the outlook is somewhat favorable. At all events the furnaces for burning powdered coal are similar enough to those used for oil firing to make a change-over a far less serious matter than when using ordinary coal. As we have frequently intimated, the use of fuel oil is not a matter of engineering but of sheer commercialism. As a fuel it is excellent and easily applied, but the question of cost is an entirely different story, particularly when one looks a little to the future.

Finally, passing from these matters of combustion to the utilization of the "white coal" of which the supply is perpetually renewed, one of the very striking improvements of the last decade has been in the design and construction of large water turbines. Single waterwheels of 40,000 hp. capacity have already been installed, while bigger ones are under consideration. What is more, the efficiency obtained, due to size, care in design and fine finish of the working parts, has reached a point far beyond anything which could have been predicted at the beginning of the century. Hydraulic efficiencies from water to generator terminals very close to 90 per cent have already been recorded. Most of the advance has been made in turbines of the Francis type, which are now in use up to heads of many hundred feet. The impulse wheel, the mainstay of hydro-electric plants in their earlier development, has, however, not been left unimproved. It has been increased in size to a maximum of 15,000 hp. With these splendid possibilities in the use of large and efficient units in hydro-electric work, the possibilities of efficient development, particularly where long storage is necessary, are vastly increased.

Equalization of Load Factor

EQUALIZATION of load factor is a problem of such importance that every widespread power distribution system must of necessity seek its solution. In this issue it is discussed in an interesting way with reference to a plant at Pine Bluff, Ark. This plant is not a large one, the connected load being only a few thousand horsepower, with about 250 miles (400 km.) of distribution line operated at from 33,000 volts to 2,300 volts. A particularly striking feature of the system is that its situation and the industrial conditions of the territory it serves lend themselves readily to equalization of load throughout the year, gaining in a small territory in a limited way the objectives which must be sought whenever a widespread distribution from a large station is attempted.

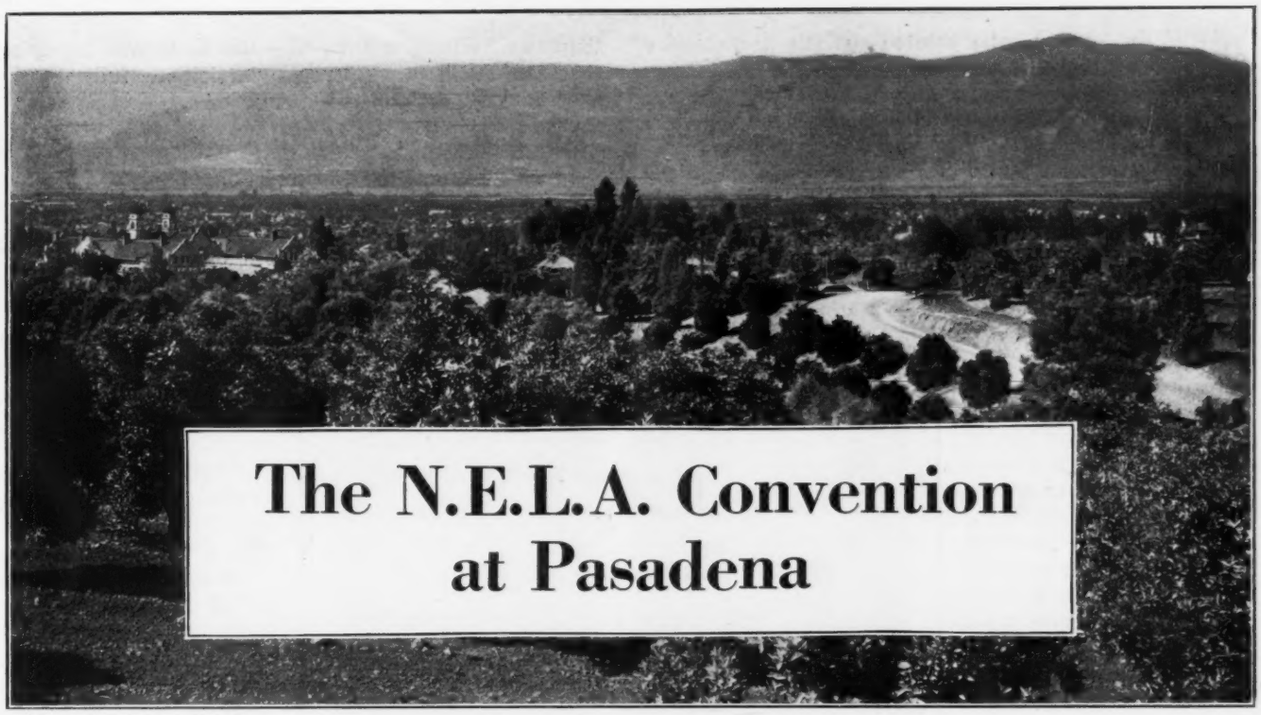
It happens that in this part of Arkansas there is an irrigation pumping load for the rice fields through the spring and summer. In autumn and early winter this load is replaced by cotton ginning and the rest of the year by the cottonseed-oil mills, which furnish a ready market for power. These three loads, coming virtually in succession, enable the year's business to be kept at a fairly steady level, taken, of course, in connection with the miscellaneous power and lighting on the system. There are more than fifty motor-driven irrigation wells for this purpose, serving a total area of nearly 7,000 acres (2,800 hectares) of rice fields. As the pumping load falls off the cotton gins begin to come on, a 1,000-kw. connected load altogether, with an all-day call for power. As the cotton is ginned and this load diminishes the cottonseed mills start up, running from midnight Sunday to midnight Saturday, with an almost continuous and steady load. The sequence gives in a small region an extremely good opportunity to obtain efficient use of the generating plant. A widespread system diversity of load with respect to season can be sought on a larger scale and with similar good results in the yearly load factor.



Martin J. Insull

who was elected president of the N. E. L. A. at Pasadena last week, is responsible for the administration of one of the most extensive utility investment and management organizations in this country

SINCE 1912 Martin J. Insull, as vice-president of the Middle West Utilities Company, has had executive charge of the management of public utility properties in sixteen states. While these properties extend from Maine to Oklahoma, the company's holdings are heaviest in the Mississippi Valley. Approximately five hundred communities are served by this far-spreading organization, which embraces no less than thirty-two subsidiary companies. Mr. Insull is one among not a few engineers or utility executives who, born in Europe, came to the United States early in the electrical era and grew up with the industry. He was born in Reading, England, on Sept. 18, 1869, and spent a few years in the telephone business before he left that country for America, which was in March, 1887. His brother, Samuel Insull, now president of the Commonwealth Edison Company, had preceded him by six years, and Martin Insull's first connection in this country was with the Edison Machine Works at Schenectady, N. Y., where his brother was secretary and treasurer and Mr. Edison's representative in charge of its general management. Martin Insull remained in Schenectady until 1889, resigning to enter Cornell University, where he took the course in mechanical engineering. Upon graduation in 1893 he became a partner of Sargent & Lundy, and five years later organized the Martin J. Insull Company to act as manufacturers' agents. About a year later, when this business was turned over to the General Incandescent Arc Light Company of New York, Mr. Insull became vice-president and general manager for that firm and for the New York Electric Equipment Company. In 1902, when the former company was acquired by the General Electric Company and the plant moved to Pittsfield, Mass., Mr. Insull became president. When the Stanley G. I. Manufacturing Company was formed, through the merger of the General Incandescent Arc Light Company with the Stanley Company, he was elected second vice-president in charge of its Middle West business, with headquarters in Chicago. In 1906 he resigned that position to take charge of the gas, electric lighting, water and railway properties in and around New Albany and Jeffersonville, Ind. These properties in 1912 were taken over by the Middle West Utilities Company and Mr. Insull was made its senior vice-president. He is also a director of the Public Service Company of Northern Illinois.



The N.E.L.A. Convention at Pasadena

Four sessions were devoted to general topics. President Ballard's address and some of the committee reports of the first two sessions were abstracted in last week's ELECTRICAL WORLD. The remaining reports are abstracted in the following pages:

Constitution and Bylaws, W. C. L. Eglin chairman.
Company Sections, F. A. Birch chairman.
Safety Rules, W. C. L. Eglin chairman.
Public Information, John F. Gilchrist chairman.
Co-operation in the Electrical Industry, Lee H. Newbert chairman.
Insurance, E. J. Fowler chairman.
Accident Prevention, Charles B. Scott chairman.
Sale of Company Securities, George R. Jones chairman.
Education, Fred R. Jenkins chairman.
Lamps, Frank W. Smith chairman.
Salesman's Handbook, I. Lungaard chairman.
Advertising and Publicity Bureau, L. D. Gibbs chairman.

THE forty-third convention of the National Electric Light Association, which was held at the Hotel Huntington, Pasadena, Cal., last week, will long be remembered by those who attended it for the lavish, varied and original entertainment provided. A precedent has been set which will be hard to surpass even at Hot Springs, Ark., where the convention is likely to be held next year.

Besides the technical and industrial application reports, which were unusually good this year, there were several subjects discussed that stood out above all others. These were water-power development, service, rewards for efficiency, trend of regulation, electrification of railroads, public policy, public information, co-operation in the industry and sale of company securities.

Considerable reorganization was recommended that will make the association still more useful. Chief among the changes were the constitutional amendments broadening the membership of committees, the formation of a Public Relations Section, a technical advisory committee and a hydro-electric prime movers committee, the nationalization of the Technical and Commercial Sections, making the Vehicle Section a division of the Commercial Section and placing the Accounting Section on a par with other sections, and establishing a Southwestern Geographic Section. Some of these changes await the final indorsement of the executive committee.

The Public Relations Section, which will be formed of company executives, will consider principally public utility finances, public information, co-operation in the industry and regulatory laws. The chairman is J. E. Davidson, Nebraska Power Company, Omaha. The other new section chairmen are: Technical Section, I. E. Moultrop; Commercial Section, M. S. Seelman, and Accounting Section, J. C. Van Duyne.

Prof. Elihu Thomson is chairman of the new technical advisory committee, to be assisted by Dr. E. A. Kennelly, professor of electrical engineering at Harvard and the Massachusetts Institute of Technology, and Prof. Charles H. Scott of Yale. To meet the needs of hydro-electric companies better subjects appertaining to them will be divorced from the prime movers committee and will be handled in the future by a hydro-electric prime movers committee, of which Markham Cheever, Utah Power & Light Company, has been asked to become chairman.

MARTIN J. INSULL ELECTED PRESIDENT

For the term 1920-1921 the following officers were elected: President, Martin J. Insull; first vice-president, M. R. Bump; second vice-president, F. W. Smith; third vice-president, Walter H. Johnson; fourth vice-president, F. T. Griffith; treasurer, H. C. Abell.

In last week's issue of the ELECTRICAL WORLD, besides a general summary of the convention proceedings, abstracts were printed of President Ballard's address and of the addresses of the retiring section chairmen, as well as of the reports of the committees on public policy, water power, and electrical resources of the nation. The papers of S. M. Kennedy on "Service," Commissioner Edgerton of California on "Rewards for Efficiency" and Commissioner Jackson of Wisconsin on "Trend of Regulation" were also summarized, as was the report of W. H. Blood, Jr., insurance expert.

The province of the Society for Electrical Development in popularizing the electrical industry and educating the public was emphasized by J. M. Wakeman, man-

ager of the society, who pointed out the advantage of having a neutral organization to supervise a co-operative campaign.

CONSTITUTION REVISED TO HARMONIZE WITH NEW ORGANIZATION PLAN

Working with the special committee on organization, the committee on constitution and by-laws, William C. L. Eglin chairman, has rewritten the association constitution to agree with the reorganization plan. The new constitution and by-laws have been recommended to the executive committee for adoption and will be submitted to the convention. To finance the expense of the enlarged activities of the association a change in the dues has been made. Provision has been made for a technical advisory committee with which the technical committee may consult regarding research to be carried out.

A committee consisting of H. C. Abell, I. E. Moultrop and Guy Talbott was appointed to consider the proposed changes and suggestions and later reported as follows:

"In consideration of the water-power committee's report and bearing in mind present regulation, needed financial support of the industry and increased cost of conducting business, our study of the changes has led to the belief that to secure maximum service from the organization at the minimum expenditure of money and labor the revision should be adopted."

The motion was carried unanimously.

COMPANY SECTIONS

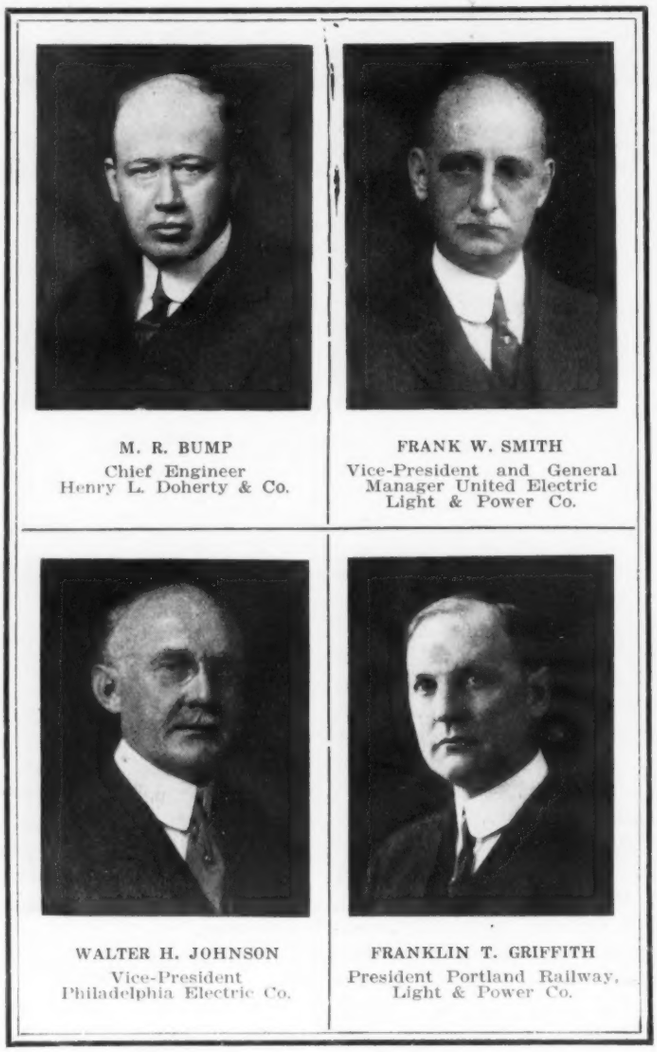
Following the adoption at the last convention of the amendment to the constitution which provided more liberal membership conditions for the company sections, the company sections committee, F. A. Birch chairman, organized a number of sub-committees and immediately instituted a comprehensive campaign for the reorganization of those sections which had disbanded during the war period. The results of this campaign were somewhat disappointing. The former sections have not generally responded to the committee's solicitations. There are at present only twenty-three active company sections, an increase of only four in a year.

SAFETY RULES

The work of the committee on safety rules, W. C. L. Eglin chairman, involved a survey of the country. This is still under discussion. It was particularly urged that there be national action, and the hope was expressed that the Pacific Coast would participate fully in this work and not develop rules of its own.

STATE BUREAUS OF PUBLIC INFORMATION ESTABLISHED

In carrying out the work of the committee on public information, John F. Gilchrist chairman, it was deemed desirable that efforts should be conducted on broad lines in which all utilities could join on equal terms, each state selecting a committee to direct the plan, the chairman of which should be the public utility man in the state best fitted to conduct such work without regard to the particular utility with which he was connected. Visits were made to and correspondence carried on with utility men in the various states, with the result that committees have been formed in Indiana, Kentucky, Ohio and Nebraska and preliminary steps looking to such action have been taken in Iowa, Wisconsin and Texas. The work of the Illinois committee, formed in April, 1919, has proved very successful. In adopting its policy this committee recognized that, though in tendering a news service relating to public utilities to newspaper editors it might be looked upon with suspicion, yet if the matter was fair, had good news value and was informative and not argumentative, the newspapers could be depended upon to print a sufficient amount to warrant the effort. This expectation proved to be correct. In starting the issuance of the news matter a letter was sent out to all newspapers in the state, about 900 in number, advising them of the formation of the committee and its object. As a result of this work, which has been going on for a year, the committee has in its files clippings from about 300 papers, aggregating 21,000 column inches of matter. As only 300 of the 900 papers in the state were subscribed for by the committee, it is assumed that the total would exceed 60,000 column inches. To meet the expenses of this committee a subscription was asked from the larger utilities in the state, based upon one-two-hundredth per cent of their annual gross revenue. Four calls for this amount have been made, aggregating over $20,000.



M. R. BUMP
Chief Engineer
Henry L. Doherty & Co.

FRANK W. SMITH
Vice-President and General Manager United Electric Light & Power Co.

WALTER H. JOHNSON
Vice-President
Philadelphia Electric Co.

FRANKLIN T. GRIFFITH
President Portland Railway, Light & Power Co.

The four vice-presidents of the N. E. L. A. elected at Pasadena, for 1920-21

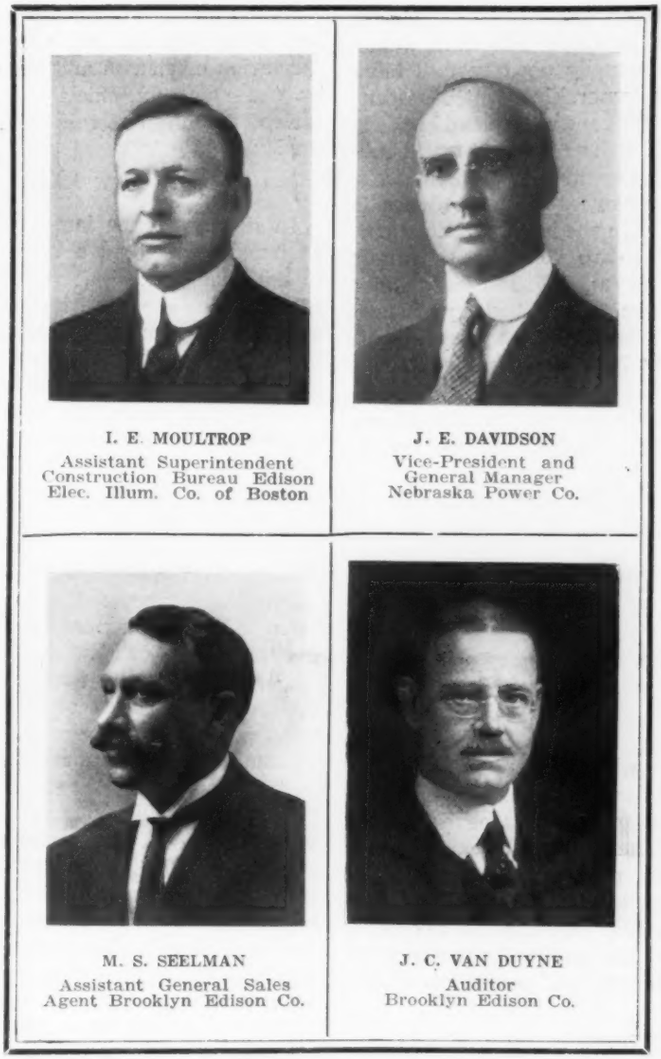
CO-OPERATION IN THE INDUSTRY

In its report the committee on co-operation in the electrical industry, Lee H. Newbert chairman, summarized the various co-operative movements and included a

detailed account of the work of the California Electrical Co-operative Campaign. Reference was made to the able work of the Society for Electrical Development and its staff, to the Jovian Order, to the National Association of Electrical Contractors and Dealers and to the Commercial Section of the N. E. L. A. In addition to these four national movements, the committee also recognized the co-operative promotion work done by the National Electrical Supply Jobbers' Association, the Conference Club, the various manufacturers' associations and others both nationally and locally. The work the California Electrical Co-operative Campaign has conducted since the plan was approved and launched by the executive committee of the N. E. L. A., Pacific Coast Section, at the Riverside convention in 1917 was outlined by the committee in great detail, mention being made that the fund subscribed annually to the movement has grown from $12,400 in 1918 to $27,000 in 1920.

Finally the committee stated as its opinion that to obtain the best results two things are needed—first, local organizations by states or groups of states as may best suit local conditions to carry on active field work; second, national co-ordination and co-operation.

In the discussion on the committee's report M. S. Seelman of the Brooklyn (N. Y.) Edison Company, pointed out that while the central station was the natural channel for appliance sales in early days, contractor-dealers have increased in number and improved their business methods so that they can be relied on almost entirely now. W. E. Robertson, Robertson Cataract Company, Buffalo, N. Y., said that the jobbers approved of nationalizing the California campaign. He suggested that such an organization could popularize utility securities and emphasize their stability. In this work he offered the co-operation of the jobbers' association and urged that some jobbers be appointed to the national association's committee on co-operation.



I. E. MOULTROP
Assistant Superintendent Construction Bureau Edison Elec. Illum. Co. of Boston

J. E. DAVIDSON
Vice-President and General Manager Nebraska Power Co.

M. S. SEELMAN
Assistant General Sales Agent Brooklyn Edison Co.

J. C. VAN DUYNE
Auditor Brooklyn Edison Co.

Section chairmen elected at Pasadena for 1920-21. Mr. Moultrop was re-elected chairman of Technical Section; Mr. Davidson, chairman of the new Public Relations Section; Mr. Seelman, chairman of Commercial Section, and Mr. Van Duyne, chairman of Accounting Section

INSURANCE RATES TOO HIGH

That premium rates on stations, substations and other property of the modern fireproof type of construction are very much higher than they should be is the conclusion drawn by the report of the committee on insurance, E. J. Fowler chairman. It is thought that this has been due to the fact that the reduction in premium rates has not kept pace with the rapid improvement in fire risks, and the committee recommends that all sub-committees of the various geographic sections of the National Electric Light Association should take up the matter of their rates with the various geographic insurance boards. The ratio of loss to the amount of insurance paid is about thirteen times as great for the small-city, group-utilities company as for the large city. This emphasizes the great opportunity that exists for reduction in the cost of insurance for those companies which have not yet replaced the old type of construction with the modern fireproof type.

Supplementing the report of the committee is a paper by J. G. Reese on "Does Insurance Receive the Attention It Deserves?" The author points out the extent to which this important financial feature has been neglected or at best has received half-hearted attention.

ACCIDENT PREVENTION

The committee on accident prevention, Charles B. Scott chairman, prepared detail reports on equipment for testing gloves, a list of rules for accident prevention, resuscitation, grounding, illumination, linemen's belts, testing and guarding high-tension equipment, placing of nameplates and other subjects. For some time the testing of rubber gloves has been studied, with the result that last year the committee put forward specifications for the purchase, testing and care of these articles. This year it presents a report on "a simple equipment for making voltage tests of rubber gloves" with a supplement on "additional glove-testing equipment used by some of the larger companies."

In a detail report a short set of general rules is presented dealing with the prevention of accidents. These can, with slight modification, be put into effect quite generally.

The committee has investigated for the past few years the method of changing insulators on high-tension lines while alive and, as a result of the investigation during the past year, wishes to put itself on record that it is not in position at this time to recommend definitely the

use of any method of maintenance work on high-tension transmission lines while alive, but does recommend that whenever possible all such circuits be killed before any work is done on them.

CUSTOMER OWNERSHIP

In its report the committee on sale of company securities to customer and residential citizens, George R. Jones chairman, stated that upward of $100,000,000 has already been borrowed by central stations from their customers. Judging from statements that come from all sections of the country, the cost of obtaining new money under this plan is much less than under the underwriting plan. Universally good results have been realized from customer ownership of utility securities, and its working out brings, first, the immediate financial results and, second, indirect permanent benefits. Next to the financial aspects of the plan, the immediate effect upon the employees of the utilities is of great importance, especially in the latest development, where companies use their entire force to sell their securities to the public. Employees begin to learn about their company's affairs; things that had always baffled them seem to straighten out; they find that gross income is not net profit and that the boss is the same kind of a man they are.

Beneficial as are the immediate direct results of the customer ownership plan, the indirect lasting results are still better. People who have never cared whether the company prospered or not once they become stockholders will become interested in its welfare. If the company has been the object of attack and suspicion, it will find that a fuller appreciation of its problems will almost invariably result. As an outcome of the customer ownership policy the new attitude toward utilities is evidenced in the reduction of complaints, lessening of unscrupulous attacks, assistance given toward obtaining rights-of-way and co-operative endeavor to adjust rates fairly.

Another important lesson which the plan teaches is that if a community wants to be prosperous it must help its utilities to be prosperous, for one is dependent upon the other, and the people of the community can be made to see that the money they place at the disposal of the utility for new turbines and power lines will not only come back to them directly through the dividends which their money earns but also indirectly through the industries which the new turbines and power lines make possible.

EDUCATION

The committee on education, Fred R. Jenkins chairman, reported that notwithstanding generally increased costs the educational courses are still self-supporting, although the tuition fees remain the same. On Oct. 1, 1919, all restrictions were removed as to subscription to these courses, permitting their sale to all who desire to subscribe. During the past year all lessons in the commercial engineering course have been reprinted and the course in practical electricity is being revised.

The committee's advertising has been combined with that of the committee on education of the Accounting Section, covering the courses issued by both sections. It is recommended that for the coming year advertisements for these courses be inserted in selected trade papers, this method being now a practical one owing to the unrestricted sale of the courses.

The fullest success of the courses is contingent upon the following conditions: First—A full realization by the executives of member companies as to their proper value in training their employees; second—co-operation of each member company with its employees in the promotion of these courses; third—co-operation by member companies with their employees in financing the tuition fee for the courses; fourth—appointment of some one in each company to superintend actively the organization and conducting of classes; fifth—an immediate and active indorsement of these courses by every member company.

In the discussion on the report the plan of interesting employees in educational courses through the formation of classes and the direct supervision of work by the company officials was considered well worth serious attention at this time because of the high labor turnover.

NEW ERA IN LIGHTING

In its report the lamp committee, Frank W. Smith chairman, presented a brief exposition of the changes in the lamp situation. It was pointed out that a potent factor in the new lighting is the progress in the design and construction of reflectors, for a new era of artificial lighting is just beginning, which will do much to restore the lighting load to its old-time prestige.

While the committee made no attempt this year to resurvey central-station lamp practice, yet it may be stated that available information shows no considerable change to have taken place since the presentation of the last annual report. Although total sales of large lamps, excluding miniatures, amounted to 183,000,000 in 1919 as against 186,000,000 in 1918, sales of tungsten-filament types increased 4,000,000 to 170,000,000, while sales of carbon-filament type lamps fell off 7,000,000, to a total of 13,000,000.

Decrease in average watts was probably brought about by the readjustment of war industries in which high-wattage units had been used very largely. The trend of candlepower, watts and efficiency is shown by a curve in the report.

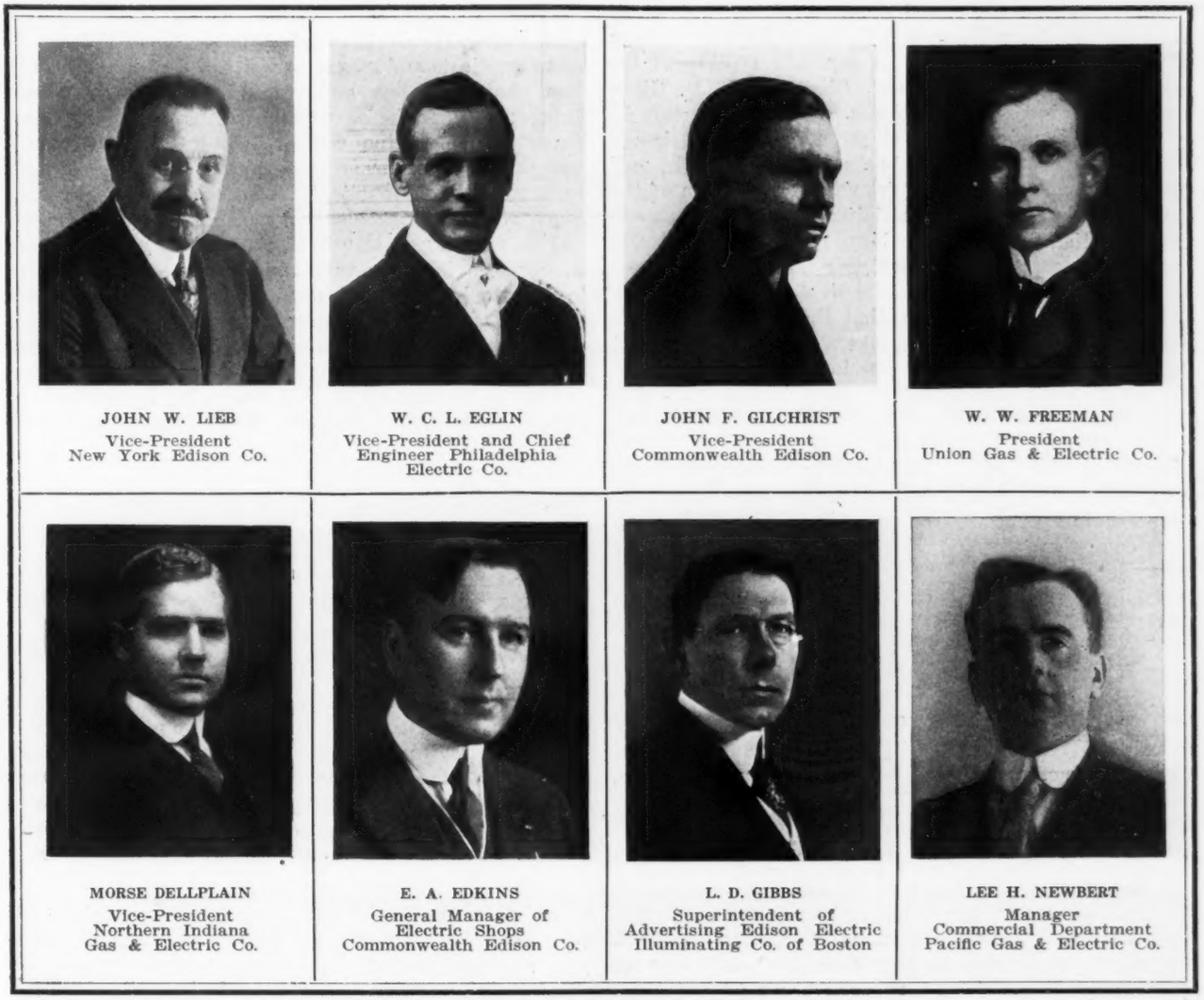
Of the 170,000,000 tungsten lamps sold in 1919, 143,000,000 were of the vacuum type compared with 142,000,000 in 1918, and 27,000,000 were of the gas-filled type compared with 24,000,000 in 1918. In number of lamps the multiple group represented 92 per cent of the total tungsten lamp sales in 1919. The 40-watt lamp continues to be the most popular size, with the 25-watt lamp a close second. The demand for the 50-watt size (vacuum) exceeds one-eighth of the combined demand of all sizes of vacuum lamps in the multiple group and is the only size of this group that showed in 1919 an increased demand over 1918 and has shown some slight gain in popularity each year. This 50-watt lamp is recommended to member companies as an excellent size for general lighting purposes. The 60-watt lamp continues to hold third place in popularity. In at least one very large company it is used almost exclusively for home lighting.

During 1919 the average candlepower of street series lamps was 155 compared with 157 in 1918, the slight reduction being due to the lesser proportion of 250-cp. and 400-cp. sizes used, excluding lamps of 250 cp. and higher, which are used largely in place of the old carbon arc lamps. The 6.6-amp. continues to be the most popular circuit.

More than 85 per cent of all lamps were of the 110-volt to 125-volt range. Nearly 79 per cent of these were

of the three standard voltages, 110, 115 and 120, compared with less than 75 per cent in 1918.

The discussion emphasized the fact that good lighting makes good work easier, while poor lighting causes bad work. All of the power companies should obtain the best personnel and equipment for rendering better lighting service to their consumers. While it may not appear that this expense is justified in increased returns, aration of a course in service relations with customers similar to the accounting and technical courses. A position of special importance in such a service sales organization is the telephone board, and only employees thoroughly trained for this work should operate it. It is becoming daily a more important link in the company's work through the increased use of the telephone by the public to transact its business with the utility.



JOHN W. LIEB
Vice-President
New York Edison Co.

W. C. L. EGLIN
Vice-President and Chief Engineer Philadelphia Electric Co.

JOHN F. GILCHRIST
Vice-President
Commonwealth Edison Co.

W. W. FREEMAN
President
Union Gas & Electric Co.

MORSE DELLPLAIN
Vice-President
Northern Indiana Gas & Electric Co.

E. A. EDKINS
General Manager of Electric Shops
Commonwealth Edison Co.

L. D. GIBBS
Superintendent of Advertising Edison Electric Illuminating Co. of Boston

LEE H. NEWBERT
Manager
Commercial Department
Pacific Gas & Electric Co.

Group of committee chairmen who presented reports at Pasadena convention: Mr. Lieb, committee on gas and electric service; Mr. Eglin, committee on safety rules; Mr. Gilchrist, committee on public information; Mr. Freeman, vice-chairman, public policy committee; Mr. DellPlain, division power sales bureau on electric development; Mr. Edkins, merchandise sales bureau; Mr. Gibbs, advertising and publicity bureau, and Mr. Newbert, committee on co-operation in the industry. Other chairmen of technical and commercial committees appear on page 1243.

yet the good will that will accrue will more than offset the expenditure.

Relations with Customers

Elimination of red tape in executing orders for connection and disconnection of service and methods of handling complaints were given particular attention in the report of the committee on commercial service and relations with customers, R. F. Bonsall chairman. The committee renews the suggestion made in its 1919 report, that member companies form a committee composed of the various departments serving the public to formulate and apply efficient methods of conducting relations with customers. It also recommends the prep-

In the issuance of service application and orders it is important that trained employees be used to prevent the loss of time by the operating departments because of incomplete or indefinite information on the orders. The service sales idea should also predominate in the obtaining of credit data. Customers' bookkeeping is also a part of such a service group, although it is in direct connection with the accounting department. In the same manner the meter readers form a definite part of such a group. This is also true in collections, where the exercise of proper judgment makes many friends for the company. The committee's report may be said to be a treatise on the development of "service sales" as a well-defined obligation of a public utility, having the

value measured by an appraisal of what can be produced in results as compared with its cost.

Conversing with customers over the telephone is a very important factor in maintaining friendly relations, said S. F. D. Buer, Denver, in discussion. By taking a sympathetic stand a complaint department can often transform a dissatisfied customer into a friend.

PLANS TO SYSTEMATIZE AND EXTEND

In reviewing results and progress of the first year's work of the Advertising and Publicity Service Bureau of the Commercial Section in separate reports of the eight divisions of the bureau, Chairman L. D. Gibbs made the following suggestions: (1) There should be a textbook on advertising, either a printed and bound volume or a loose-leaf hint book; (2) plans might well be made for an exhibit at next year's convention of the service rendered by the advertising agencies; (3) street-car advertising service has been requested by several central stations; (4) a request this last year for advertising material in connection with a safety first campaign brought out the fact that there was almost no available material; (5) a speakers' bureau is in great demand; (6) other associations interested in sales and promotion work might well be asked to appoint representatives to membership of each of the eight divisions.

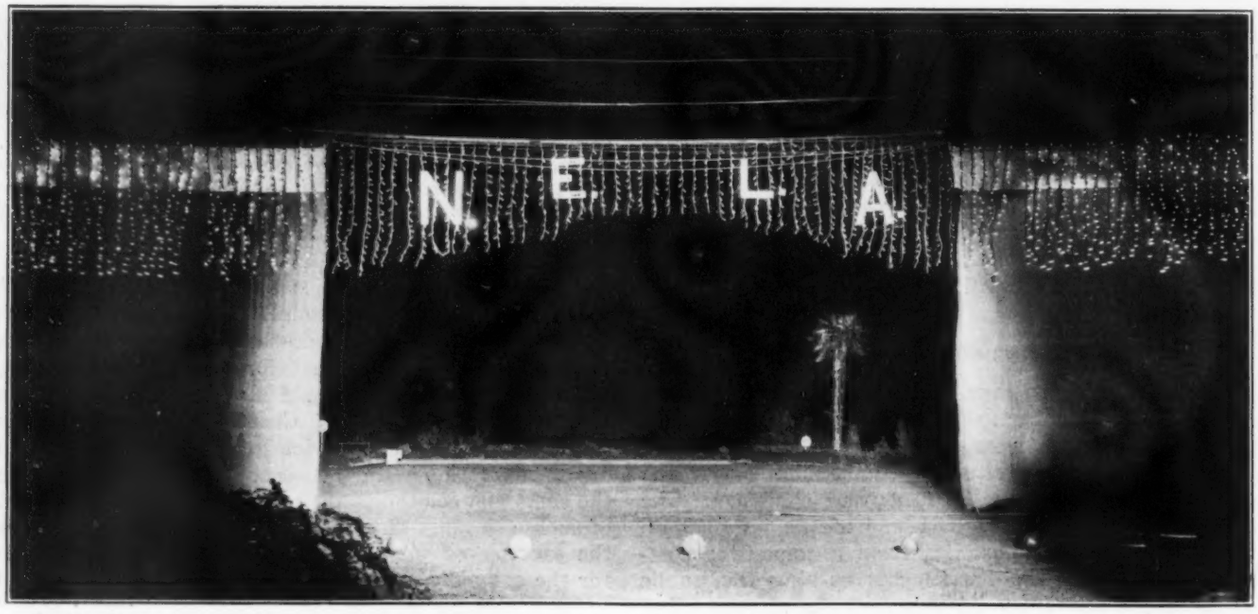
Co-ordinate Advertising and Sales Campaigns.—Merchandising and lighting schedules as a basis for planning advertising and sales campaigns have this year been put into effect by the co-ordinate advertising and sales campaigns division, Henry Harris chairman. The schedules agreed upon are as follows: Merchandising schedules—January, clearance sale; February, heating pads; March, vacuum cleaners; April, sewing machines and sewing-machine motors; May, grills; June, irons; July, fans; August, clearance sale; September, washing machines; October, radiant heaters; November, toasters; December, electrical Christmas gifts. Lighting Schedule—January, better lighting; February, outdoor lighting (tennis courts, playgrounds, etc.); March, stores and windows; April, residence lighting; May, electrical advertising; June, public buildings; July, industrial; August, stores and windows; September, electrical advertising; October, residences; November, better lighting (with emphasis on office buildings); December, industrial.

Motion Picture Advertising to Be Studied.—Convinced that cinematographic presentation has developed so rapidly that it must now be recognized as second only to the printed page as a means of communicating thought, the motion-picture films division, headed by Charles H. Peirson, emphasized the importance of using this powerful medium of contact with American people.

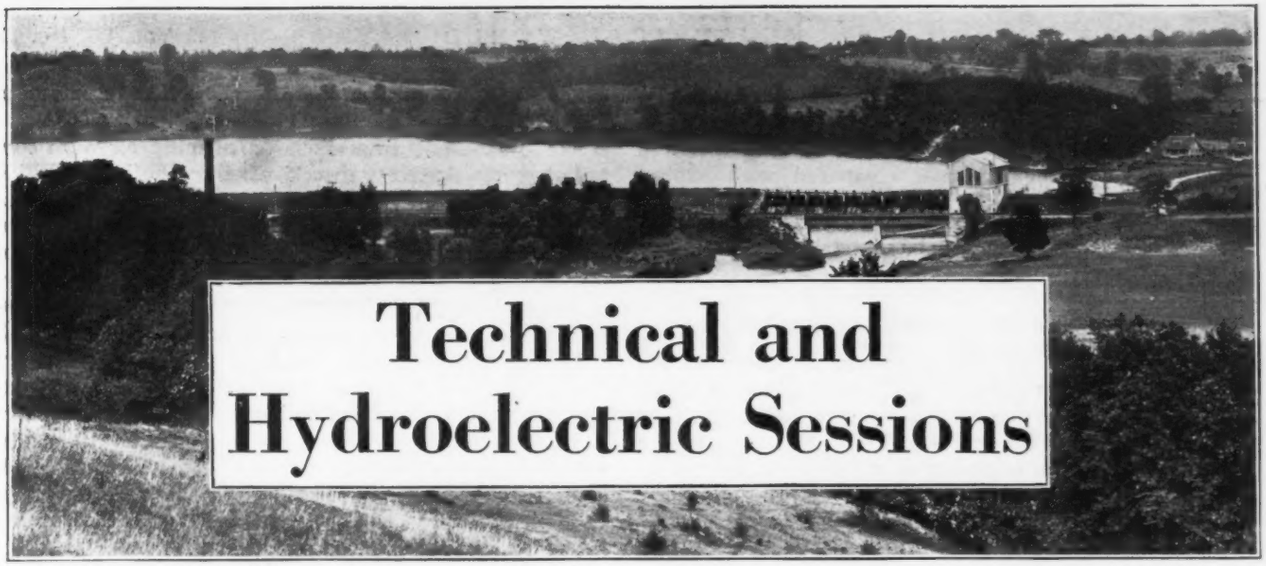
Reaching Public Through Popular Periodicals.—The news syndicate and magazine writers' division, Frank B. Rae chairman, has endeavored to accomplish three things: (1) To devise a method or plan whereby newspaper and magazine writers, editors of newspapers, newspaper syndicates and magazines, and others of value in disseminating public information, may be kept in touch with electrical developments of popular interest; (2) to familiarize men of authority and responsibility in our own industry with the objects and methods of legitimate publicity, as distinguished both from paid advertising and mere puffery; (3) to initiate a syndicate newspaper service devoted to popular electrical subjects, and especially to the use of home appliances, said service to be comparable in form to fashion, household, recipe and similar newspaper "departments" commonly published in the daily press.

General Commodity Advertising to Show Electrical Goods in Background.—The national commodity advertisers' division, Earl E. Whitehouse chairman, was established this year for the pupose of exerting an influence on the advertisers of general commodities to feature electrical appliances in the background of their advertising display.

Non-Technical Handbook on Illumination.—The newly organized division for non-technical applications of illuminating engineering, of which P. B. Zimmerman is chairman, has determined to publish two pieces of literature, the first to be an outline of a promotional sales campaign in the industrial field and the second a handbook on the subject of industrial lighting—a non-technical book that can be considered a complete encyclopedia on the subject.



ELECTRICAL CURTAIN FOR OUTDOOR ENTERTAINMENT STAGE AT PRESIDENT'S RECEPTION ON LAWN OF HUNTINGTON HOTEL



Technical and Hydroelectric Sessions

At the two sessions of the Technical and Hydro-Electric Section reports were presented by committees on the following subjects:

Meters, F. V. Magalhaes chairman.
Electrical Apparatus, R. F. Schuchardt chairman.
Overhead Systems, W. K. Vanderpoel chairman.
Prime Movers, N. A. Carle chairman.
Inductive Interference, A. E. Silver chairman.
Underground Systems, F. E. Ricketts chairman.

CHAIRMAN I. E. MOULTROP in his address to the Technical and Hydro-Electric Section outlined the work of committees and explained that the new organization of the association provides the machinery for technical committees in geographic divisions and state associations. It will be the duty of the national section to keep in touch with the geographic divisions and give them needed assistance, so that instead of having technical committees of their own the needs of the geographic divisions will be satisfied by representation on the national section committees. The speakers covered the main points of the work of the electrical apparatus committee, committee on inductive interference, committee on meters, overhead systems committee, committee on prime movers, and committee on underground systems.

Plant Equipment and Practice

The report of the prime movers committee appears in abstract on page 1257. Owing to the short time available for discussion of this report only five sections were brought up for consideration, namely, turbines, water power, condensers, oil burning and pulverized-fuel burning.

The manufacturers' viewpoint on turbines was touched upon by E. E. Gilbert of the General Electric Company, E. Sniffin of the Westinghouse Electric & Manufacturing Company and F. L. Webster of the Allis-Chalmers Manufacturing Company. Mr. Gilbert said that economy can be sacrificed for reliability. While Mr. Sniffin agreed with the committee regarding the present advisable limits to turbine ratings, he expressed the belief that larger units can be operated with safety if the design is modified. Instead of an oil outlet temperature of 140 deg. he recommended 160 deg., since this is safe and permits use of oil of higher viscosity. With an oil of the same viscosity as for 140 deg. the higher temperature will reduce the drag on the turbine. Bearings have worked satisfactorily with oil outlet temperatures as high as 200 deg., he said. Since piping to turbine must be laid out to allow movement in all directions, there is great opportunity for improvement in piping arrangements, Mr. Sniffin contended. Mr. Webster pointed out how his company meets operating requirements in the construction of turbines.

R. J. C. Wood, Southern California Edison Company, Los Angeles, voiced a general need for information on reliability of turbines, differentiating between trouble with operation and inherent design. N. A. Carle pointed out that the Edison association is investigating this subject.

S. J. Lisberger, Pacific Gas & Electric Company, San Francisco, is investigating the practicability of refrigeration in connection with bearings and condensers. L. M. Klauber, San Diego (Cal.) Consolidated Gas & Electric Company, announced that he is using sea water to cool turbine bearings. Steadying devices have to be used on the turbine governors to permit paralleling generators with those of the Southern California Edison Company, he declared.

Water-Power Tendencies

In discussing water power, consideration was given chiefly to tendencies in size and type of plants, the performance of a new type of runner, the advisability of outdoor stations and automatic plants, the measurement of precipitation in the mountains and methods of operating hydro-electric plants.

There is a tendency to larger and larger hydro-electric plants, said E. C. Hutchinson, Pelton Water Wheel Company, but medium-size powers are also being developed extensively, probably to avoid too great an investment before the market can absorb the power. While he contended that the Nagler runner had poor regulating characteristics and a short high-efficiency period, F. L. Webster contended that with low heads, such as are obtained in the Middle West, the regulating characteristics, efficiency and stability are all that can be desired.

Where there are low heads and no large amount of water to be impounded, as in the Middle West, there is an excellent field for automatic hydro-electric plants, declared E. W. Allen, General Electric Company. However, H. A. Barre, Southern California Edison Company, Los Angeles, contended that the tendency to

automatic operation is becoming a fad like outdoor stations and should be carefully considered first to determine the advisability of such practice in view of the relatively low labor expenses compared with capital charges in hydro-electric plants. Regarding outdoor stations, Mr. Barre said that unless an inclosure is provided in which to repair and overhaul equipment operators are very liable to neglect maintenance.

Operating Hydro-Electric Plants

Discussing some of the operating problems of his company, Mr. Barre referred to the arrangements which have been made for operating some generators at either of two frequencies (50 cycles and 60 cycles), depending on whether his own company or a purchasing company requires the surplus power. Details of this plan were published in the Electrical World for July 19, 1919.

When operating the 50-cycle generator at 60 cycles there is a reduction in efficiency of 9.2 per cent, but this is less than with a frequency changer. However, to the surprise of the company, it was possible to obtain larger outputs from the generators at the higher frequency. In general, the Southern California Edison Company operates its stream-flow and reservoir water-power plants on the base load when there is plenty of water, the steam plants carrying the fluctuations. During dry weather the base load is carried on steam plants to obtain the highest economy and fluctuations on reservoir plants. While the water which will be available each year can be forecast pretty accurately, there is need of some means of measuring precipitation in the mountains. At present the rate of inflow to the reservoirs, with observations of precipitation at gaging stations in the lowlands, is the basis of estimates.

S. J. Lisberger, Pacific Gas & Electric Company, San Francisco, said the method of operating plants followed by his company is similar to that outlined by Mr. Barre. Considerable difficulty has been experienced, however, in keeping vertical waterwheels on the bus after a short circuit opens a switch, owing to overspeeding of the unit. To avoid this trouble the governors have been adjusted to permit 12 per cent overspeeding. Eliminating any lag in the flow of the governor oil was suggested as another means of remedying the trouble.

Because of the extreme length of the hydro-electric transmission lines feeding Denver, the base load, made up of the most important loads, is carried on the local steam plant, said T. O. Kennedy, Denver Gas & Electric Company, and the loads of lesser importance on the water-power system. The buses are normally tied together by an oil switch which can be opened if transmission service is interrupted and the steam plant cannot carry the entire load.

The greatest problem of operating hydro-electric and steam systems owned by different companies in parallel is the assessing of charges for interchange of power, according to the views expressed by both Mr. Kennedy and L. L. Elden, Boston Edison Company. Maintenance of a constant frequency is very important in the East, owing to the effect on industrial production.

J. P. Jollyman, Pacific Gas & Electric Company, referred to a hydro-electric plant which his company operates at variable heads—70 ft. to 200 ft. (21 m. to 60 m.)—as a sort of blow-off for a reservoir to reduce waste of water and wear on gates.

The discussion on condensers was light, Mr. Barre suggesting that condensers be sectionalized so that one compartment might be flooded to allow cleaning of tubes without shutting down the entire unit.

Three excellent discussions on burning oil were contributed by A. H. Babcock of the Southern Pacific Company, Dr. E. S. Jacobus of the B. & W. Boiler Company, and C. R. Weymouth of C. C. Moore & Company, one discussing particularly the relative merits of mechanical and steam atomizers, another construction of boilers, the third important factors which should receive consideration in equipping an oil-burning plant.

In the paper by Mr. Babcock it was brought out that mechanical atomizers handle fluctuating loads better than steam atomizers and utilize the furnace space to better advantage, because the oil spray is discharged with a helical motion that permits better mixture of air and oil. Furthermore, because of their capacity for overloads, fewer mechanical atomizers are required per boiler; the efficiency of combustion is also higher.

Two hundred per cent has been the maximum boiler rating obtained with steam atomizers, whereas mechanical atomizers have produced as high as 400 per cent with good feed water and forced draft. For the reason mentioned steam atomizers can burn about 2½ lb. of oil per cubic foot of furnace volume, whereas mechanical nozzles can burn 10 lb. At normal boiler ratings the efficiencies obtained with the two types of burners are about equal, but at 240 per cent rating the efficiency is six points in favor of mechanical atomization.

Mr. Weymouth recommended not heating oil in storage tanks above 80 deg. to 90 deg. The temperature should be raised to about 180 deg. (depending on viscosity) between the pumps and burners, and self-cleaning strainers should be provided for Mexican oils. Economizers do not show so much advantage with oil as with coal, but steel casings for boiler settings do, particularly at low loads. Mr. Weymouth expressed the belief that the National Fire Protection Association rulings on oil burning are too drastic and suggested that a committee be appointed to obtain this modification according to past good practice. He also said many consumers of native oil cannot have their contracts renewed after the present ones expire, though the East is in a position to obtain foreign oil from Mexico.

Dr. Jacobus announced in his discussion that boilers can now be provided that will develop 150,000 lb. of steam per hour and that they can be built for 450 lb. pressure with slight modification. Wrought-iron economizers are available, internal corrosion being prevented by previously extracting oxygen from the water and external pitting being eliminated by preheating water to 140 deg. to 150 deg. by exhaust steam. Boilers fired with blast-furnace gas have had their efficiencies raised from 50 to 78 per cent. It was recommended that economizers should not have more than 70 per cent of boiler surface for safety. Boilers can now be provided twenty-six tubes high, a construction which affords longer travel of gases.

The discussion on burning pulverized coal was contributed by H. D. Savage of the Pulverized Fuel Company and F. A. Scheffler of the Fuller Engineering Company. The first speaker considered the combustion of pulverized coal as distinguished from the method of handling it and presented numerous sets of test data and heat balances for various plants burning different kinds of coal from lignite to anthracite silt and culm. Mr. Scheffler referred to the success which has been obtained with disposal of ashes of air conveyor systems.

Developments in Apparatus

On page 1261 an abstract is given of the report of the electrical apparatus committee. The following points were brought out in the discussions on it:

To protect against generator fires, the Redondo and Long Beach stations of the Southern California Edison Company are equipped to shut off the ventilating air and admit steam to stifle combustion. The system at Redondo has operated twice and been effective both times. At station A of the Pacific Gas & Electric Company a generator fire was started by a defective clamp that allowed ignition of some dirt on the insulation, R. C. Powell declared. The field circuit was opened, but the armature and field were damaged enough to require rewinding. By keeping its machines well cleaned the Great Western Power Company has avoided generator fires so far, said J. A. Koontz.

G. H. Bragg, Pacific Gas & Electric Company, San Francisco, said that the company has many synchronous-motor drives in substations, but they hold on as well as induction motors in case of trouble. No trouble is experienced with rotaries, owing to long lines of high inductance. The speaker expressed the opinion that tubing supported by pin-type or post-type insulators is more desirable than flexible conductors in strain, since the former construction requires less steel. To permit taking an oil switch out of service without interrupting service, Mr. Bragg favors providing a by-pass air-break switch between the disconnecting switches on the side away from the oil switch.

N. A. CARLE
Chief Engineer
Public Service Electric Co.

A. E. SILVER
Electrical Engineer
Electric Bond & Share Co.

R. F. SCHUCHARDT
Electrical Engineer
Commonwealth Edison Co.

W. K. VANDERPOEL
Superintendent
Public Service Electric Co.

F. V. MAGALHAES
Superintendent
Meter and Test Departments,
New York Edison Company

F. E. RICKETTS
Superintendent Electric
Stations, Consolidated Gas,
Electric Light & Power Co.

R. S. HALE
Superintendent Research
Department, Edison Electric
Illuminating Co. of Boston

JOHN W. MEYERS
Assistant
Sales Manager
Philadelphia Electric Co.

Chairmen of technical committees who presented reports at Pasadena convention: Mr. Carle, committee on prime movers; Mr. Silver, committee on inductive interference; Mr. Schuchardt, committee on electrical apparatus; Mr. Vanderpoel, committee on overhead systems; Mr. Magalhaes, committee on meters; Mr. Ricketts, committee on underground systems; Mr. Hale, committee on wiring, and Mr. Meyers, division of Power Sales Bureau on Economics of Use of Central Station Power. Reports of the last two committees were presented at Commercial Section sessions.

H. A. Barre said that synchronous condensers at the Eagle Rock substation of the Southern California Edison Company, were the only means whereby Big Creek transmission was made possible. Without them the voltage variations would be 47 per cent. Under present conditions, however, the voltage can be maintained the same at both ends up to a load of 50,000 kw. To carry full load a lagging kva. is produced by the zero field on the condensers. To start, the shafts are floated by oil, greatly reducing the starting kva.

Trouble with rotary converters has been practically eliminated by increasing the speed, separating the poles more (hence increasing the neutral zone) and by the use of high-reluctance commutating poles. With the latter, which have non-magnetic material between them and the frame, barriers between brushes are almost unnecessary. High-speed breakers have also helped considerably. One remedy for the oil-switch situation is to simplify switch construction and make the switches large enough, H. A. Barre declared. In the new Kern River station of the Southern California Edison Company no low-voltage buses or switches are used, switching being done on the high side. The station service is provided very easily by having step-down transformers. At another station this company is using a single-pole switch between each generator and transformer for synchronizing and using high-tension switches for protection. The auxiliary power is supplied over transmission line with direct-connected exciters.

A. W. Copley, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., expressed the belief that putting protection on top of protection may constitute a hazard. A method of rating circuit breakers cannot be established without operators agreeing on what they require. At present oil switches cannot be applied properly without considering the methods of system switching as well as the kva. to be ruptured.

J. E. Kearns, General Electric Company, referred to a new arrangement of switches for a 180,000-kva. to a 200,000-kva. substation in Chicago, devised by Mr. Jamieson. All switches of the same phase are in a row, thus reducing the size of the building required. The disconnecting switches are opened automatically when the oil switches open. A method of operating oil switches without control circuits, one that involves circulating high-frequency current through the main circuits, is being investigated by the General Electric Company.

Although the electric apparatus committee advocated subtractive polarity for transformers under 200 kva. and 7,500 volts, W. K. Vanderpoel, Public Service Electric Company, Newark, N. J., expressed the belief that many companies would object to this recommendation because transformers are in a class by themselves.

While standardization of transformer oils was recommended by A. E. Silver, Electric Bond & Share Company, New York City, manufacturing representatives declared that it would be impracticable to do this because in most apparatus the kind of oil required depends upon the internal construction and materials used. Mr. Silver said that, on high-voltage systems particularly, standardization of such oils would mean immense economy to the operating companies. In reply to this, M. O. Troy, General Electric Company, said that standardization cannot be allowed to retard development. Besides, oil does not run uniformly. There is one form of standardization, however, that will be desirable from both operating and manufacturing viewpoints, he said, and that is the standardization of ratings. This can be carried out very effectively and will be the means of reducing the cost of equipment considerably as less stock will have to be carried by the manufacturing company. If the electric apparatus committee could investigate whether it is a recommendable practice to use Y-grounded systems or not, it would be a great help to operating companies because the use of the grounded system will reduce the cost of an entire installation more than one-third.

Meters

Necessity for standardization of disk constants of watt-hour meters of the same ampere rating and voltage range, increasing in direct proportion to the capacity of various makes of meters, and of standardization of terminal dimensions and provisions for mounting current transformers was pointed out by the report of the committee on meters, F. V. Magalhaes chairman. Standardization of the disk contents would greatly simplify the testing formulas and calculations used by testers, thus saving the cost of tests and eliminating much of the possibility of error. This is particularly necessary at present because of the difficulty of obtaining competent readers and testers. Considerable expense would be saved in making changes of transformers were the terminals to be standardized, it was pointed out, because frequently when necessity for changes arise transformers of the same type and rating are not to be had and new mountings have to be installed to hold whatever type of transformer may be available.

The committee reports the completion of Section 10 of the meter code, on demand meters, thus completing the entire code, which has been in the course of preparation for thirteen years. The entire section is printed in the report. Under the subject of new development considerably more activity was reported than last year, following the period of the war. Experimental or completed developments were mentioned along the line of devices for kva. measurements reported by practically all of the manufacturers, as well as a number of improved demand meters.

In the discussion of the report interest was manifested in the characteristics of current transformers, the education of metermen, standardization of disk constants, definition of polyphase power factor and use of meter protective equipment. O. A. Knopp of the Pacific Gas & Electric Company, San Francisco, pointed out that it is wrong to compare current transformers by their phase angles unless the secondary power factors are taken into consideration. The volt-ampere capacity of current transformers must also be given serious consideration, said R. C. Lanphier, Sangamo Electric Company, otherwise accuracy may be sacrificed, particularly in polyphase units. Twenty-five volt-amperes to 35 volt-amperes was recommended as a desirable rating. This factor is not so important in the voltage transformers, but instrument manufacturers would like to have operating companies as a body specify the characteristics desired in all instrument transformers under various conditions. Instruction courses for metermen have been conducted with great satisfaction at the University of Iowa and will be started at the University of Illinois this summer.

The discussion indicated a need of information on the extent to which meter protective devices are employed, the purpose for which they are used (prevention of theft, or to facilitate test) and whether the customer, the utility or both shall shoulder the expense.

The revision of Bureau of Standards Bulletin No. 56, which refers to meters and measurements, will be conducted in co-operation with a sub-committee of the N. E. L. A. meter committee, F. V. Magalhaes, New York Edison Company, announced.

Overhead Systems

The principal activities of the committee of overhead systems, as reported by W. K. Vanderpoel, chairman, have been in the direction of improving the maintenance of suspension-type insulators, pointing out the advantages of preservative treatment for poles and cross-arms, and undertaking a study of overhead-line construction in co-operation with the Bureau of Standards for the purpose of bringing the National Electrical Safety Code to a satisfactory state of completion.

In connection with the work on insulator and maintenance, the committee sent out questionnaires which brought forth valuable information regarding suspension insulator practice. The approximate number of suspension units used per string for various voltages was found to be as follows:

Kv.	Companies Reporting	Wood Poles Suspension	Wood Poles Tension	Steel Suspension	Steel Tension
13	1	..	..	2 to 3	4
33	2	2 to 3	3 to 4	2 to 3	2 to 5
44	1	3	4	3	4
66	17	3 to 6	4 to 7	3 to 8	4 to 9
88	1	..	..	4 to 5	5 to 7
110	11	8	10	5 to 9	5 to 9
130	1	9 to 10	11 to 12	9 to 10	11 to 12
140	1	..	..	10	12
150	1	..	..	9	11

Of the methods of testing, the questionnaire developed thirty-three answers, of which seventeen indicated the use of the megger, seven the "buzz stick," one the oscillator, six no method at all, one visual inspection only, and one a special device of its own. It appeared that operating engineers ascribed the following reasons, in the order of their importance, for insulator deterioration: (1) Porosity; (2) minute cracks, permitting absorption of moisture; (3) troubles from expansion resulting from dissimilarity in coefficients of temperature expansion of porcelain, cement and hardware. It is the consensus of opinion, however, that difficulties due to porosity have been greatly diminished in the case of those insulators manufactured within the last five years. There have been many schemes proposed for the determination of porosity of insulators, but only one method seems to be effective, and that is the Fuchsine dye test.

Opinions regarding the protection afforded by ground wires are conflicting. Few operators believe that the ground wire protects lines from severe direct strokes of lightning, but there is a considerable difference of opinion regarding the protection obtained from induced lightning charges.

The practice of banking transformers is not so general as might be expected in view of the many advantages attendant upon such operation. This attitude is ascribed to the trouble experienced in restoring service after a local interruption, and some suggestions are given for overcoming such difficulties.

It is recommended that operating companies consider carefully the feasibility of treating poles. Whether the open-tank methods of brush treatments should be used will, of course, depend upon the extent and distribution of the work. The practice of one large operating company and the Bell telephone companies in pole treatment are given in the report.

Very interesting photographs of automotive equipment for line maintenance and construction work is given in the report of the committee, and some practical tools and devices are shown for line construction work.

Insulator testing and maintenance, pole reinforcement and treatment and joint usage of poles were the principal subjects touched upon in the discussion on the report of the committee on overhead systems. Some rather unusual temperature-cycle tests of insulators are being conducted by J. A. Koontz, Great Western Power Company, San Francisco, in which various types of insulators are subjected to cyclic temperature changes ranging from 32 deg. to 140 deg., under various conditions of strain and operating conditions. Thermocouples are inserted in some insulators to determine distribution of temperatures. The effect of continued testing on aging is also being investigated. Since each unit of a string of insulators is not always in perfect condition, H. A. Barre, Southern California Edison Company, Los Angeles, recommended that distribution of voltage over strings containing faulty disks be studied and compared with distribution over perfect strings.

J. P. Jollyman, Pacific Gas & Electric Company, San Francisco, pointed out that insulators give less trouble when dry or drenched with water than when dirty or subjected to ocean spray, fog, drizzling rain, etc.; therefore tests should be conducted under the more severe conditions.

Curves showing the rate of depreciation of insulators in service over an extended period were presented by C. F. Benham, Great Western Power Company, San Francisco. The results were segregated according to the climatic conditions to which they were subjected. Those in coast hill districts depreciated the most rapidly, those in mountain districts next, and those in the dry upper valleys least.

Deterioration of Suspension Insulators Under Different Climatic Conditions

R. J. C. Wood, Southern California Edison Company, Los Angeles, reported more trouble with insulators supporting the central conductors on a steel-tower line than with outside conductors. Owing to the fact that these insulators were surrounded by a steel structure, whereas the others were not, Mr. Wood suggested that this condition might have caused the exaggerated trouble observed.

L. M. Klauber, San Diego (Cal.) Consolidated Gas & Electric Company, urged using as many insulator disks per string as possible, especially where daily cyclic temperature changes are extreme and where insulators are subjected to salt spray or other deposits.

Because of the importance of reliable service on large systems and the magnitude of the total capital charges compared with the cost of transmission equipment, R. M. Boykin, North Coast Power Company, Portland, Ore., contended that it is economically feasible to spend more money on insulation and maintenance.

J. B. Fisken, Washington Power Company, Spokane, Wash., referred to the increased life obtained from poles which had been purposely charred and then treated with hot creosote at 150 deg. Fahr. Since reinforcing of poles with steel bars driven into the wood weakens the fiber, Mr. Fisken recommended casting concrete around the butts, a method that had given great satisfaction. The cost is very reasonable. To inspect the

condition of poles it was suggested that small holes be bored radially into them. This operation does not weaken the poles appreciably. By boring holes axially in the butts of poles and connecting the inner end with the atmosphere by small drill holes the interior of the poles might be impregnated by the open-tank method very effectively.

Results of tests conducted by the Forest Service at Madison, Wis. (Project 214), were outlined by R. E. Cunningham of the Southern California Edison Company, Los Angeles. The tests included investigations of the effectiveness of open-tank creosote, zinc chloride and creosote brush treatments, the first method being the most effective.

Growing Seriousness of Inductive Interference with Telephone Lines

Among the many points brought out by the report of the committee on inductive interference, A. E. Silver chairman, is the danger that lies in overemphasizing the benefit of keeping power and communication lines on separate routes or highways. While it is very desirable to encourage this policy within reason, particularly in planning for future growth, yet with the higher distribution and lower transmission voltages this is becoming increasingly difficult and expensive. With the multiplying demands for central-station power, it is essential that methods of co-ordinating the communication and power facilities be developed and applied with foresight.

Among the requirements to improve the situation, in the judgment of the committee, is generai recognition of the principle that adequate power and communication service economically supplied are both essential to the public interest and that the companies supplying these services have a mutual responsibility to the public. This responsibility to the public does not lessen the responsibility of the power industry to itself in maintaining an equitable division of the liability arising from the inductive interference situation. It is the purpose of the committee therefore to establish definite procedure among the power companies for community of effort to avoid the inconsistencies and inequality of individual dealings with the trained staff of the telephone company with its fully prepared and nationwide policy.

In discussing this report the serious situation facing the power companies in meeting the demands of the telephone companies was emphasized by J. E. Woodbridge, of Ford, Bacon & Davis, and by G. E. Quinan, Seattle. Both John A. Britton and D. L. Huntington, Washington Water Power Company, spoke from an executive standpoint. They were followed by M. R. Bump of New York, who urged prompt action of the companies on a co-operative basis.

H. S. Warren, American Telephone & Telegraph Company, expressed the desire of the telephone interests to carry on a joint investigation of the subject on its merits with the intention of carrying out the conclusions irrespective of individual interests, a suggestion which was welcomed by the electric light and power companies.

W. G. Taylor, General Electric Company, urged the recognition of both sides of the problem—the susceptibility of telephone lines to inductive interference as well as the problem of the transmission company—suggesting the maintenance of a permanent co-operative body to handle this problem.

Underground Systems

After a careful study of the single conductor versus the three-conductor cable for high voltages, the committee on underground systems, F. E. Ricketts chairman, has come to the conclusion that for tensions up to 25,000 volts and loads up to 10,000 kva. the three-conductor cable is more economical than single-conductor cable, but it points out the possibilities and the advantages of the single-conductor design for higher voltages and greater loads.

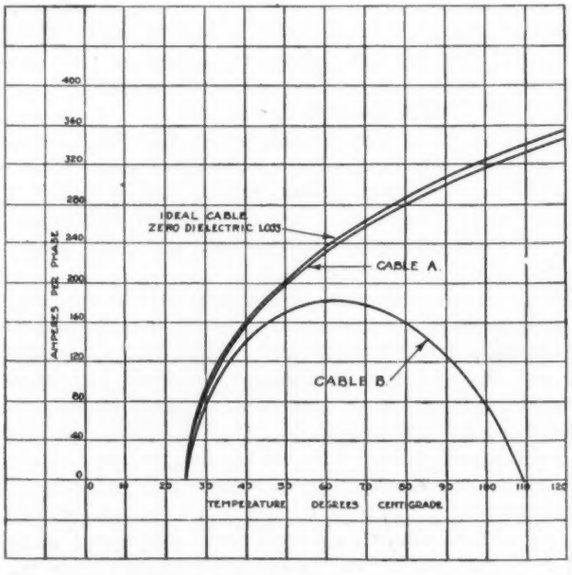
The subject of current-carrying capacity of underground cables as affected by dielectric and copper losses and temperature of duct lines is discussed, and the variation of the characteristics of the different tables are brought out.

Among the most important recommendations made by the committee is that covering specifications, developed in conjunction with the transmission and distribution committee of the A. I. E. E., for paper-insulated, lead-covered underground cable.

Reducing Disastrous Effects of Cable Failures on Direct-Current Networks of Large Capacity

It is the recommendation of the committee that companies give careful consideration to the prevention of extended troubles on direct-current networks, as considerable damage from this cause has occurred in the past. If, for instance, low-tension distribution cables are not bonded in each manhole, then in the case of a cable burning in two, the arc assisted by the molten metal will practically put positive or negative potential on the lead sheath and cause the burning of holes in lead sheath and arcing between the lead sheath and points of support. If other cables are in metallic contact with racks or supports, this positive or negative potential of the lead will be communicated to such other cables and may cause a rapid spread of the trouble which otherwise might be localized.

As in the report for 1918, the committee has included



CURRENT-CARRYING CAPACITY OF CABLES FOR VARIOUS DEGREES OF TEMPERATURE RISE

statistics of high-tension cable failures, and it has also presented them for the year 1919. Operating results in 1919 appear to have been considerably better than in preceding years, showing only 8.2 failures per 100 miles of cable as compared with 13.1 during 1918. It is impossible to draw any general conclusions with only two years' data at hand, but the improvement is due in part to the replacing of old-type joints by some companies, to more favorable weather conditions in certain localities for the dissipation of heat, and in some cases to the reinforcing of feeders to clear up overload conditions.

R. T. Lozier, National Conduit & Cable Company, New York City, urged more exchange of experience on underground cable operation since it will help manufacturers meet requirements better.

Steam Railroad Electrification

The report of the committee on electrification of steam railroads, F. M. Kerr, vice-president Montana Power Company, chairman, consisted of separate reports by the following members: A. H. Armstrong, chairman electrification committee of the General Electric Company; R. Beeuwkes, electrical engineer Chicago, Milwaukee & St. Paul Railway; H. H. Cochrane, chief engineer Montana Power Company; Peter Junkersfeld, engineering manager Stone & Webster; F. H. Shepard, director of heavy traction for Westinghouse Electric & Manufacturing Company, and J. E. Woodbridge, resident engineer with Ford, Bacon & Davis, San Francisco.

Mr. Kerr explained that the committee found it advisable to discuss electrification from the viewpoint of the purchaser and the seller of electrical energy for railway purposes. He said that the Chicago, Milwaukee & St. Paul Railway and the Montana Power Company have demonstrated in Montana the entire practicability and the great superiority of electric power for the operation of a heavy trunk-line railway by more than four years of 100 per cent operation. The total yearly cost of operation averages about $11,000 per mile for the entire system of 10,000 miles. The cost of electrical energy purchased for the Rocky Mountain division is $1,600 per mile, or less than 15 per cent of the average total cost for the system.

Electrified Railroad as a Power Consumer

Mr. Cochrane discussed power supply for electrification on the basis of experience obtained in supplying power to the Butte, Anaconda & Pacific and the Chicago, Milwaukee & St. Paul Railways.

He suggested that in future electrification projects the power company own all high-voltage lines, switches and transformers and deliver power to the railway at a suitable voltage for its motor-generator sets or whatever converting apparatus is used. With this arrangement the power company would own all the equipment necessary to supply consumers other than the railroad along electrified sections.

Mr. Cochrane pointed out that the ideal rate for a railroad is a straight kilowatt-hour rate. Peak loads do not come at the same time as a general thing, and the fact that they exist is ascertained by referring to the records rather than by any physical effect which they have on the power system. The power factor is about unity, and the load is so scattered that fluctuations in railroad loads have practically no effect on voltage regulation. The load factor on the entire division was about 50 per cent. Combining the total railway load with that of the rest of the Montana Power Company's system makes a total load with a daily load factor frequently in excess of 90 per cent, typical figures at present being 144,000 kw. average and 160,000 kw. maximum.

Energy Supply to Railroads

Mr. Junkersfeld discussed the requisites of an equitable power contract for railways. He said that the contract for power should provide automatically for wide fluctuations in cost of labor, fuel and other principal elements. This may take the form of a simple rate, perhaps a "block" rate, based upon both demand and consumption, with a provision for revision at suitable intervals at the option of either party to correct it for unforeseen conditions—changes in the art, in the purchasing power of money, in interest rates, in taxes and in other factors which may affect the cost of electric service.

Electrification Economical for Railroads

F. W. Bellinger outlined the electric operation of the Butte, Anaconda & Pacific Railway since 1912 and gave data on the cost of locomotive maintenance, which varied from 5.3 cents per locomotive-mile in 1914 to 6.8 cents in 1919. He compared this with 16.1 cents per locomotive-mile for steam operation in 1909.

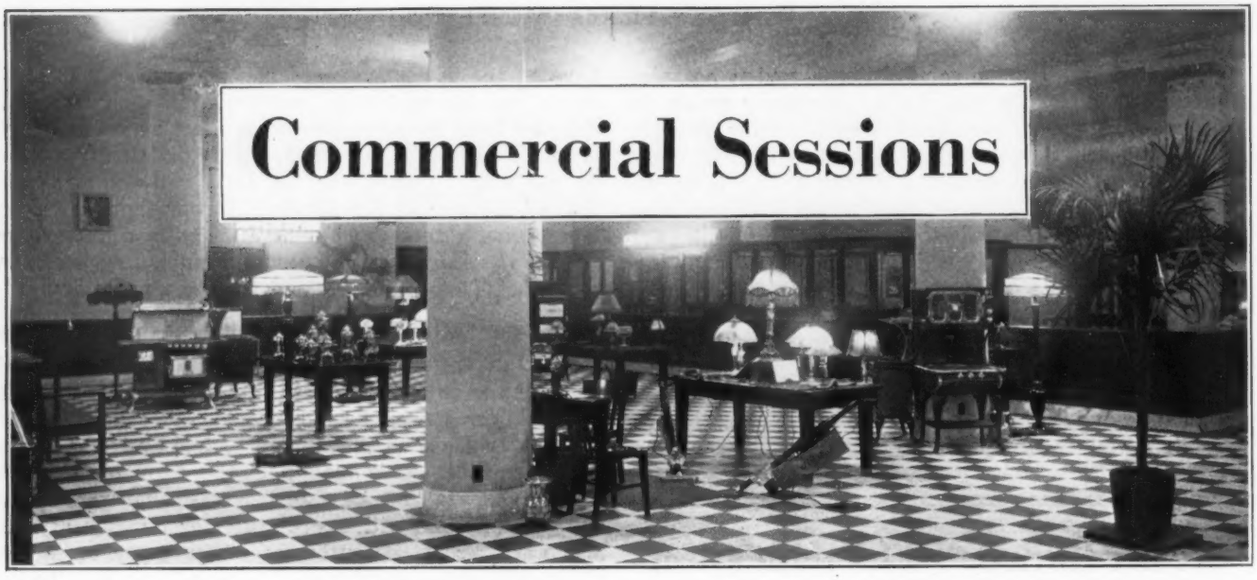
For the Chicago, Milwaukee & St. Paul electrification Mr. Beeuwkes gave details of first cost and comparative operating data for electrified and steam operated divisions which showed that the repairs were much less than for the steam locomotives replaced. He pointed out that electrification had in most respects far exceeded the expectations of the railway organization from an operating standpoint.

Mr. Shepard, in reviewing the service and needs of railroads, pointed out that the traffic of the country doubles about each twelve years, so that facilities must be provided in advance of needs without regard to the necessity for immediate financial return. The physical means by which the most can be obtained from the railroad plant is electrification.

Mr. Armstrong stated that a total consumption of about 53,500,000 tons is a rough approximation of the coal required to produce the electric power to haul the tonnage of 1918 by electric locomotives. This indicates the possible saving of 122,500,000 tons of coal as the annual return on universal electrification of the country's railways. Electrification, he said, involves no experiment with novel and untried apparatus. On the contrary, universal electrification could well follow closely along the lines of installations now in successful operation.

In discussing this report, the success of actual electrifications was confirmed by various companies. W. C. L. Eglin testified to the success of the electrified divisions in the Philadelphia district, as did also F. W. Smith of New York. The viewpoint of railroad men was presented by A. H. Babcock of the Southern Pacific Railroad, who pointed out the importance of disillusioning company officials who believe that money can be better spent in double-tracking systems or along other lines with which they are familiar.

Commercial Sessions



Meetings of the Commercial Section, presided over by John G. Learned, chairman, were held on the afternoons of Wednesday, Thursday and Friday. The following committee reports and papers were presented:

Wiring, R. S. Hale chairman.
Merchandise Sales, E. A. Edkins chairman.
Electrical Merchandise, F. D. Pembleton chairman.
Electrical Shop Management, C. E. Greenwood chairman.
Standardization and Testing, O. R. Hogue chairman.
Electric Range, J. Paul Clayton chairman.
"Electrical Salesman's Handbook," I. Lundgaard chairman.
Economics of the Use of Central-Station Electric Power, John W. Meyer chairman.
Electrochemical Processes, C. H. McClure chairman.
Industrial Electric Heating, N. T. Wilcox chairman.
Lighting Sales, Clarence L. Law chairman.
Street and Highway Lighting, W. T. Dempsey chairman.
Residence Lighting, M. Luckiesh chairman.
Commercial Aspects of Lamp Equipment, George H. Stickney chairman.
Industrial Lighting, H. H. Magdsick chairman.
Compensation of Salesmen, Adolph Hertz chairman.
Electric Steel Furnaces, Joseph McKinley chairman.
General Power, W. E. Murphy chairman. and "Electric Power in the Oil Fields," by W. G. Taylor.
Power Contract, R. H. Ashworth chairman.
Electric Development, Morse Dell Plain chairman.
Commercial Service and Relations with Customers, R. F. Bonsall chairman.
"Use of Central-Station Power in Electric Furnaces," Robert M. Keeney.

THE work of the Commercial Section this year, as outlined by the chairman, John G. Learned, has been to establish the Advertising and Publicity Bureau and the Merchandise Sales Bureau, to compile new booklets, issue circulars, etc., to hold frequent conferences, and in general to maintain an organization for developing the commercial phases of the industry and for disseminating knowledge pertaining thereto. The growing need by central stations of just such knowledge was pointed out by the chairman.

Merchandising

Four divisions compose the report of the Merchandise Sales Bureau, E. A. Edkins chairman—electrical merchandise, electric ranges, store management, and standardization and testing.

With regard to general commercial conditions the committee stated that it seemed doubtful that any decided drop in prices or curtailment of demand on the part of the buying public would come so suddenly as to have a serious effect within the present calendar year. The inevitable decline, however, cannot be far distant, and future delivery orders for 1921 should therefore be placed with considerable conservatism and on a shorter time basis.

Development of a merchandising cost system which will include all of the expense properly chargeable to this department is essential if the sale of electrical merchandise is to be successful, according to the report of the Electrical Merchandise Division, F. D. Pembleton chairman. From figures compiled to show the cost of doing business it was found that there was a wide difference among the companies, varying from as low as 10 per cent to 32.4 per cent, based on the selling price of the goods sold.

Average Electric Range's Revenue $47.47 per Year

In the past two years a very large number of electric ranges have been sold, so that there are now about 75,000 ranges in use in the United States as compared with only about 10,000 in 1915, it was stated by the electric range division, J. Paul Clayton chairman. A conservative estimate shows a market for the year 1920 of approximately 75,000 ranges, and the number to be sold this year will be limited by the producing capacities of the manufacturers.

The diversity factor of the electric range load is greater than that of any other large class of electric load and aids materially in building up a load on the residence distribution system, now the most lightly loaded of all central-station lines. The average annual income from electric ranges throughout the country for 1919 was $47.47 per range, and the average additional capital investment to serve a cooking customer is from $45 to $150.

Electric water heating has been developed successfully, especially in localities served by water power and where a low rate can be offered for this class of service. The average income from electric water heaters now in use is $40 per year.

Operations of the electric shop by the central station must be conducted on a business basis if it is to meet successfully the competition of independent dealers and jobbers, it was stated by the electric shop management division, C. E. Greenwood chairman. Price cutting as a

principle is harmful to the best interests of the industry, and no inducements of credit or deferred payments should be made which the independent retail establishment could not profitably offer.

A definite policy for the conduct of the business regarding charges, credits, exchanges, approvals and deliveries should be established, and all employees should be made thoroughly familiar with this policy. Periodic inventories should be taken indicating which are the slow movers in the stock. Unprofitable lines should be moved at a sacrifice if necessary to provide capital to be invested in new lines. The manager must know what his turnover is, which means a card system for perpetual inventory. There should be a definite plan and schedule for advertising which should tie in with the national advertising and other advertising of the distributer in the district.

TESTING BUREAU RECOMMENDED

The standardization and testing division, O. R. Hogue chairman, recommended that a national testing bureau be established for the purpose of testing all classes of electrical heating and motor-driven appliances. Such a testing bureau to be operated along lines that would furnish to its clients a thorough testing service, conducted along standardized lines and employing standard specifications to be approved by a committee consisting of representatives of central stations, jobbers, dealers, contractors, manufacturers and the N. E. L. A.

Considerable discussion followed the reading of the reports of the various divisions of the committee. Manufacturers suffered from a very bad slump between the armistice and June of last year, but at that time an avalanche of orders began to come in which completely swamped the plants, George A. Hughes, of the Edison Appliance Company of Chicago, asserted. All of the manufacturers, he continued, are trying to speed up production. As an example, next year the Electric Appliance Company will turn out 60,000 ranges that will have an average rating of 5 kw. each. Mr. Hughes explained that the present system of charging for the goods at their cost on date of shipment was due to the fact that the fluctuating prices of labor and material made it impossible to estimate with accuracy what the cost would be from day to day.

An interesting note was made by Lewis A. Lewis of the Washington Water Power Company to the effect that in his territory range installations earned 100 per cent per annum on the investment when used in connection with water heaters, collections of $80 per year being the average.

The idea of a central station trying to cut prices and so rule supreme in the merchandising field was ridiculed by A. C. McMicken of the Portland (Ore.) Railway, Light & Power Company, who said that merchandising at less than a profit is not a business builder. By working at a reasonable profit, he said, you invite electrical dealers into the field, which makes it easier for the consumer to purchase appliances. This, of course, results in greater consumption of energy, which is the point that the central station is seeking.

Anticipate enormous demands and slack periods was the message of R. W. Clark of the Puget Sound Traction, Light & Power Company, Seattle, Wash., who suggested that some work could be done along these lines so that a steady demand for appliances would be created.

Commercial Management

Consideration of the compensation of salesmen by the committee on this subject, A. Hertz chairman, has been restricted to the central-station field. The committee prepared a skeleton outline covering all the fields of a sales force in a highly specialized company. The small company may not have an individual for each phase of the work; still all the work of the smaller company is covered by the outline, which has six general branches as follows: (1)Lighting; (2) power; (3) heating; (4) light and power combined; (5) appliances; (6 technical men. Under these main branches are classifications for specialized work in each department. Having established this outline, it was necessary to determine a set of basic ratings figured on the minimum compensation paid to the men in each class.

In the discussion the sales manager's viewpoint was given by M. S. Seelman, Brooklyn, N. Y., who said that lighting salesmen have not been paid on a scale commensurate with the work done. Men should be paid enough so that they will not be attracted elsewhere, because the intimate knowledge of the business which they have learned at the company's expense should be utilized.

R. S. Hale, Boston, said that while merchandise salesmen could properly be paid on a salary and commission basis, it is only fair to the power salesmen that they be paid a straight salary as they are in no way responsible for the amount of energy used.

POWER-FACTOR CLAUSE IN POWER CONTRACTS

The importance of improving power-factor conditions from the consumers' and companies' viewpoint was considered by R. H. Ashworth, chairman of the power contract committee, in his report. He urged studying how the problem can be solved and educating the consumer regarding the importance of improving his own installation.

The results of a questionnaire indicate that there is no standard of practice on the part of the power companies, either in determining power factor or in correcting it. Rates vary from the complete omission of the power-factor clauses to the inclusion of a flat penalty for poor power factor. A method which improves conditions is the use of the kilowatt-ampere rather than the kilowatt as a basis for rates. Some companies base penalties on the demand charge only, others on the kilowatt-hours used, the latter being preferable in Mr. Ashworth's opinion.

Standardizations of methods was urged particularly to facilitate dealing with commissions and developing of instruments. Penalizing for poor power factor was urged as the best remedy and should apply below 85 per cent in proportion to power factor. The bonus plan was not so highly regarded.

The desirability of basing penalties upon demand received considerable attention in the discussion of this report, H. L. Cook, Boise, Idaho, maintaining that meter complications resulting from other methods offset the greater accuracy. The encouragement of improvement on the part of the customer being the major end in view, any method which results in a proportional penalty

should improve conditions. In many respects rates based upon kilowatt-amperes offer the best solution.

L. E. Smith, General Electric Company, felt that imposing penalties offered a better solution in that it permits the customer to make his choice of improving the power factor or shouldering the expense which his poor power factor involves.

The question is one which involves the large consumer principally, contended R. S. Hale, Boston, who indorsed the two-meter method and further agreed on the desirability of including penalties based on kilowatt-hour consumption. W. G. Vincent, Pacific Gas & Electric Company, suggested that a provisional reservation be filed with public service commissions releasing power companies from the necessity of serving customers with abnormally poor power factors.

Electric Furnaces

The high cost of metallurgical products of electrical furnaces and the growing cost of fuel assure central stations of large electric furnace loads, said Robert M. Keeney, director of department of metallurgical research, Colorado School of Mines, in his paper on the "Use of Central Station Power in Electric Furnaces." In the United States the majority of electric furnaces are operated by central-station power, which is not the case in Europe, where all plants having electric furnaces either have their own power plants or the central station has a plant set aside for this special load. The main point the electrical industry should watch in the upbuilding of this branch of the industry is the use of three-phase furnaces.

ELECTRIC STEEL FURNACE DEVELOPMENT FROM SEVERAL VIEWPOINTS

Development in electric furnace design has been toward making the furnace load more desirable to the central station, in the opinion of the electric steel furnace division, of which Joseph McKinley is chairman. Automatic charging, automatic regulation of the electrodes and increase of power capacity per ton rating of furnaces have helped in this development. The electric steel production in the United States represented 300,000,000 kw.-hr. power consumption in 1918. Figures for ten years are:

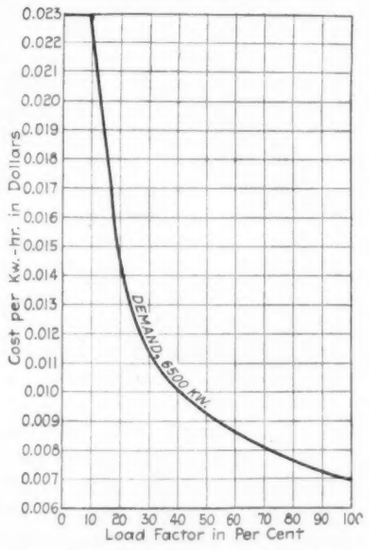
Year	Gross Tons	Year	Gross Tons
1909	13,762	1914	24,009
1910	52,141	1915	69,412
1911	29,105	1916	168,918
1912	18,309	1917	304,543
1913	30,180	1918	511,364

Considering the furnace from the user's standpoint, Edward T. Moore, in one of the papers supplementing this report, made some interesting statements regarding the cost of production of steel by this method. As shown in the curve, the power cost is a function of the load factor to a very marked degree. As a high monthly kilowatt consumption and a low peak demand produce a high load factor, it is the endeavor to keep the peak demand as low as possible. In this connection, one company has constructed a peak regulator to control the demand for power. By this means the load factor was increased from 45 per cent to nearly 60 per cent and the energy cost decreased, as shown in the curve, from 1 cent per kilowatt-hour to 0.89 cent per kilowatt-hour, which alone reduced the power cost of steel ingots approximately $1 per ton. A drop of load factor from 50 per cent to 40 per cent would mean in this case an increase in power cost of $1,800 a month with a consumption of 2,500,000 kw.-hr.

From the central-station viewpoint, as pointed out in the paper by E. C. Stone, the importance of load factor, furnace disturbances and off-peak power are fully recognized. On account of the rapid and wide fluctuations in load, electric furnaces have in some cases caused considerable disturbances in systems to which they have been connected. It is thought that "disturbance-limiting" standards may be established.

In giving the manufacturer's viewpoint W. E. Moore has shown that the manufacturer is also interested in the design of regulators to eliminate the instantaneous peaks. The factors limiting the growth of electric furnace business are the lack of power and also the lack of supplies such as electrodes and shortage of trained men for the work.

Discussing the report, Frank D. Burr of Denver said that information regarding the results obtained by the electric furnace users should be carefully compared with results promised by the manufacturers. One advantage of electric furnaces that has been particularly observed is that they have turned out 43 per cent to 51 per cent good castings, whereas with other furnaces it is not unusual for only one-sixth to be perfect. The lack of service men and the distance of the furnace installation from the factory are great disadvantages in the West. Cost of power is comparatively unimportant, but it is significant that while castings can be turned out at $38 per ton with energy at 1 cent per kilowatt-hour, compared with $57 per ton by the converter method, they would cost only $44 per ton if the rate for electric service were increased 100 per cent.



A HIGH-LOAD FACTOR IS IMPORTANT IN FURNACE WORK IN KEEPING POWER COSTS DOWN

W. L. Merrill, Schenectady, predicted that within ten years the furnace load would be greater than the entire motor load. He referred to casting anchor chain from electric steel, saying that the cost is approximately the same as that of forging, but the chain is 40 per cent stronger. Another advantage is that one man can produce sixty times as much steel chain as under the old system.

J. G. Learned pointed out that electric furnace users are now seeking power and are not only willing to pay a good rate for it, but in some cases are willing to finance the extensions and provide sufficient capital to pay for the necessary increase in the station generator capacity.

Industrial Heating

Activities of the industrial electric heating division, M. T. Wilcox chairman, were covered by three papers as follows: "The Electric Furnace for Melting Brass," by A. V. S. Lindsley; "Low-Temperature Industrial Heating," by R. T. Kaighin, and "Industrial Heating Applied to Medium and Low-Temperature Processes," by W. S. Scott.

An annual saving of $36,000,000 could be realized in the melting of brass and non-ferrous alloys by the use of electric furnaces, it was maintained by A. V. S. Lindsley in his discussion of the electric furnace for melting brass. Data on types and sizes of furnaces were given, showing an energy consumption per ton of metal melted of from 175 kw.-hr. to 300 kw.-hr., depending on the size of furnace and the nature of metal treated.

Manufacturers who formerly allowed from five to nine hours for japanning operations are now doing the same work much better with electric ovens in from thirty to sixty minutes, R. T. Kaighin stated in his paper, "Low-Temperature Industrial Heating," which covered electric heating as applied to japanning, paint drying and core baking. For japanning in Detroit there is a connected load in excess of 20,000 kw., in Toledo the electric japanning load is over 6,000 kw. and in Cleveland this load exceeds 5,000 kw.

A very complete description of the practical application and apparatus used in electric ovens was given by W. S. Scott in his paper on "Industrial Heating Applied to Medium and Low-Temperature Processes."

Industrial Heating and Advantages of Electric Furnaces

The additional advantages of electric furnaces besides the saving in heat cost were brought out in the discussion by Harold Fulwider of the General Electric Company. To show the progress that is being made in the electric furnaces, he spoke of an electric furnace to be used in the heat treating of gun forgings now being constructed. This furnace, which is 10½ ft. in diameter and 105 ft. high, will handle castings weighing 320,000 lb. and will represent a load of 2,850 kw. Central-station men should take over some of the work that had been done by the manufacturers in finding new uses for electric furnaces and ovens, he concluded.

A. C. McMicken, Portland (Ore.) Railway, Light & Power Company, said that the only two brass furnaces on the Pacific Coast, in his knowledge, are in Portland, and that the furnaces are giving excellent results. Running with an average heating cost of 1.4 cents per kilowatt-hour, they are able to compete with oil furnaces, despite the increased fuel cost, and at the same time are turning out a superior product. Besides, considerable loss in metal is being avoided. This particular load, Mr. McMicken pointed out, is not particularly attractive to the central station for two reasons —first, because the furnaces are of the single-phase type, and, second, because the power factor, even with special transformers and special reactances in them, averages only 72 per cent. Three-phase furnaces have better performance than this, the power factor in their case running around 90 per cent.

A home-made electric furnace which is being served by his company is making pig iron out of scrap metal. This furnace is of the three-phase type, turns out two tons of metal every hour and a half and has a load factor that is better than any other electric furnace served.

F. X. Mettenenet of Chicago then stated that his company has found that electric furnaces on a rate of 3 cents per kilowatt-hour are able to compete with gas furnaces, with gas selling at 65 cents per 1,000 cu.ft.

Wiring

Considerable space is devoted to the standardization of appliance plugs and housings in the report of the wiring committee, R. S. Hale chairman. The importance of this measure is being increasingly recognized, but there are two reasons why comparatively little progress has been made. The first is the genuine doubt as to the best standard, since both flat prongs and round prongs have distinct advantages and disadvantages, and further there is still a question as to whether there should be different types, one heavy and rugged for such articles as flatirons, and another type non-interchangeable with the first for light articles like heating pads, percolators, etc. The second reason is the disinclination of each manufacturer to adopt a standard other than his own.

From a letter from F. D. Goode, chairman Heating Appliance Section, A. M. E. S., it appears that of the two types of terminal structures used with flatirons at the present time—the flat type and the round—four manufacturers use the flat type. Standard attachment plugs virtually are interchangeable on these flat prongs now. At the same time six manufacturers make flatirons with round prongs. Arrangements have now been made for detail changes by some of the manufacturers which will permit the interchangeable use of a standard plug on all six of these irons in the very near future. This standardization does not yet affect all manufacturers of flat-prong or round-prong flatirons and as yet does not include appliances other than flatirons.

The committee feels that serious attention to the menace of fires from flatirons is merited, and that continued education of the public is the best way to combat this danger.

Tests on wiring at different ages are being continued, and in addition the committee is having prepared some sample boards showing different types of wiring, embracing also foreign practice. Furthermore, it is branching out into tests on portable cords, with a view toward standardization on minimum requirements based on experience. These tests are to be started this year and manufacturers have been asked to submit sample cards, confining themselves first to cords suitable for domestic iron use, No. 16, B. & S. stranded. It is hoped that through returns from appliance managers of central stations and from wiring contractors, and through laboratory tests, some rating can be given the various cords.

A description of heater cords to be tested by the Electrical Testing Laboratories under the auspices of the wiring committee and to be rated by commercial men and wiring contractors was presented under separate cover. Ratings are asked on twenty cords from nine manufacturers.

Power Service

During the past four years industry has encountered economic problems which, no doubt, existed heretofore but were not recognized because problems of seemingly greater importance demanded attention. The report of the division of the Power Sales Bureau on economics of the use of central-station power, John W. Meyer chairman, stated that probably the greatest problems to be met have been the rapidly advancing cost of labor, money and materials essential in the production of energy. These tendencies in commercial development are of interest to engineers, but a thorough understanding of them can be attained only by a detailed study of capital, gross earnings, cost of materials and replacement of capital destroyed.

The rapid growth in the use of electric drive in the textile industry was also taken up in detail by the committee.

Under "Public Utility Barometers" the committee discussed the central-station operation data being collected and published monthly by the ELECTRICAL WORLD and strongly recommended that the central-station industry lend all assistance to the ELECTRICAL WORLD in this compilation. In an excellent paper which formed a part of the committee's report H. H. Holding suggested the use of graphic records of sales to a group of representative industrial power customers as an index to industrial trade conditions.

The division on electrochemical processes, C. H. McClure chairman, allotted certain phases of its work to several members for investigation and report. The subjects treated include "Nitrogen Fixation" by C. B. Gibson of the Westinghouse Electric & Manufacturing Company. Mr. Gibson described the five processes, listing the advantages and disadvantages of each. These processes are : (1) the arc; (2) the cyanamid; (3) the nitride; (4) the direct synthetic ammonia; (5) the cyanide. The last two do not require electric energy.

A paper by J. A. Johnson of the Niagara Falls Power Company dealt with artificial abrasives.

Karl Horine of the Commonwealth Edison Company dealt with the subject of electrolytic chlorine, the importance of this industry being indicated by the capacity of plants in the United States and Canada, which in 1919 amounted to 170,000 tons per year. The electrical load is desirable to central stations both in its characteristics and its amount. It takes 2,600 kw.-hr. to produce one ton of chlorine.

A paper by C. A. Winder of the General Electric Company on the subject of phosphorus outlined the process of smelting rock phosphates with silica and carbon and showed the difficulties due to the penetrating qualities of phosphorus.

A paper on magnesium, also by Mr. Winder, described the apparatus used in the production of magnesium. The energy requirement is 25 kw.-hr. per pound.

A. F. Hibbeler of the Commonwealth Edison Company wrote on electrolytic refinement of zinc. While the electrolytic methods are scarcely past the experimental stage, their future seems assured on account of their higher efficiency.

James Brakes, Jr., of the Commonwealth Edison Company, treated the subject of electro-galvanizing, giving the various steps in the process, and described the method of cleaning the iron, which also is an electrical process. The costs of electro-galvanizing and coke and gas hot-galvanizing were compared, and the electric process was shown to be cheapest.

Another paper by C. B. Gibson was devoted to the manufacture of graphite.

The work of the division of electrical development, as outlined by the chairman, Morse DellPlain, has been along three lines: (1) new industrial electric processes; (2) special convention addressses; (3) papers for presentation before conventions of manufacturers.

There are several new wholesale uses for electric energy which should be mentioned, chief among which are purification of municipal water supply, sterilization of sewage, and dehydration of food products. In addition, the increased use of the electric furnace in the metallurgical industries has resulted in many new specific processes in that field.

Lighting Service

The activities of the Lighting Sales Bureau for the past year have been along lines similar to those of other years, though somewhat experimental, it is stated in the report of the bureau, Clarence L. Law chairman, as they were based upon a suggested organization made at the beginning of the year to determine upon a definite plan of future procedure. The bureau has operated during the year in six divisions as follows: (1) Commercial aspects of lamp equipment; (2) street and highway lighting; (3) store lighting; (4) lighting of large buildings; (5) residence lighting, and (6) industrial lighting. The chairman recommended that for the next year's work the bureau be divided into three divisions as follows: (1) Lighting practice; (2) lighting campaign; (3) lighting equipment.

It was thought that the most needed service in the field of the division on the commercial aspect of lamp equipment, G. H. Stickney chairman, would be to produce a reference book on lighting equipment, covering standard types, and to point out their merits and applications. The division has, therefore, prepared a classification of such equipments and has undertaken the collation of information which it proposes to present in a systematic form for ready reference.

The street and highway lighting division, under W. T. Dempsey, dwelt on the progress that is being made in highway lighting, park lighting, lighting fire department and police signal posts and lighting for traffic regulation.

A paper on "Lighting and the Householder," by M. Luckiesh, chairman of the residence lighting division, presented a résumé of conclusions reached by analyses of residence lighting. The keynote of the paper was that in general the householder is indifferent toward lighting.

While the central station is the only factor in the electrical industry constantly in contact with the customer, it has in the usual case failed to take the leadership in the problem of industrial lighting and, in the opinion of the industrial lighting division, of which H. H. Magdsick is chairman, the one way to correct this situation is to have men of ability who are thoroughly informed on the subject of illumination and capable of commanding respect as experts conduct the sales effort.

Electric Vehicle Sessions

The Electric Vehicle Section met on Friday afternoon, when, after the address of Chairman George B. Foster, committee reports and papers were presented to the section as follows:

Garage and Rates, Willis M. Thayer chairman.

Legislation, G. A. Freeman chairman.

"The Uses and Abuses of Electric Vehicles," by H. J. Butler and W. J. Burns.

Electric Vehicle and Power Sales Bureau Co-operation, E. S. Mansfield chairman.

Transportation Engineering, F. M. Feiker chairman.

"The Electric Truck Industry," by C. A. Street.

RAPID development of the electric vehicle business depends on adequate garage facilities. This was the point most emphasized by George B. Foster in his address before the Electric Vehicle Section. While the central stations have taken some interest in the promotion of vehicle business, as a whole the activity in this field has not been commensurate with the possibilities.

By keeping accurate cost records, promoting the establishment of suitable garages and meeting the competitor on his own ground the entire industry will be stimulated. The future of the business is very encouraging, concluded the chairman, and no central station should neglect this important field.

The discussion on the papers presented before the Electric Vehicle Section centered around the uses and abuses of electric cars. W. E. Clement of New Orleans emphasized the need of proper garages and supervision. That the present is the ideal time to sell vehicles, since they can be served without investing in line extensions, and that salesmen who have been taken off other work can well be used in this field were opinions expressed by those taking part in the discussion, among whom were G. B. Foster and E. W. Lloyd.

Making the Garage a Profitable Business

Off-peak vehicle load is profitable to the central station, but the garage, which seems to be the necessary medium through which such load is obtained, is not always profitable. For that reason the committee on garages and rates, Willis M. Thayer chairman, gave its attention to the conditions necessary to make a garage profitable.

After a careful investigation of various commercial ventures the committee has decided that a sixty-car garage is the minimum on which to establish a profitable business. The floor should be of ample size with a width of at least 60 ft. (18 m.) and length of from 150 ft. (46 m.) to 200 ft. (61 m.).

The handling of properly selected side lines is emphasized. In fact, in the opinion of the committee, a customer who does not buy his supplies through the garage should be looked on with disfavor.

While the central station has provided accommodation for electric vehicle users, better results can be obtained by operating a garage as an independent business, particularly in large cities where the business has been developed. Handling batteries for gas cars is also suggested as the volume is large and the profit good.

No Unfavorable Electric Vehicle Legislation During the Year

During the past year no legislation which discriminates against the electric vehicles has come to the attention of the committee on legislation, Chairman G. A. Freeman reported. The proposed uniform motor vehicle law, prepared by a joint committee representing the American Association of Highway Officials, the National Automobile Chamber of Commerce, the American Automobile Association and the Highway Industries Association, was briefly touched upon. In the opinion of the committee the proposed law favors the electric vehicle.

Uses and Abuses of Electric Vehicles

A paper by H. J. Butler and W. J. Burns enumerating the advantages of electric vehicles pointed out that it is easy to train help used to other lines of work to become safe operators. Another big advantage in the use of the electric truck is found in the fact that when the electric truck stops all movement of the mechanism stops. Moreover, the amount of power required can be measured in advance of purchase with instruments of precision.

A number of investigations have shown that from 15 miles to 18 miles a day is the average delivery mileage when horses are the medium. The average speed of a 2-ton electric truck is 14 miles to 15 miles per hour. This is from two to three times the speed of the horse-drawn vehicle. Of course, the field of operation of the electric truck is quite clearly defined, and rural or interurban deliveries of long mileage are purely within the radius of the gasoline truck.

Electric installation can be abused in two ways. The first way is by an attempt to have the electric truck perform long mileage at high speed, and the second is because of constant neglect of the battery.

From the accompanying chart, prepared and furnished by one of the largest operators of both gasoline and electric trucks in the United States, it can be seen that the cost per ton-mile for the gasoline truck has increased from 5.3 cents in 1915 to 6.75 cents in 1919, while the cost per ton-mile for the electric truck has decreased consistently from 4.74 cents in 1915 to 4.17 cents in 1919. Another interesting point which will be observed from reading this chart is that the average ton capacity per gas truck only increased from 3 to 3.27, while that of the electric truck in the same period increased from 1.6 to 2.7. The trucks from which these figures were compiled were all operating under equal conditions in city deliveries. The figures include all expenses except interest, depreciation, insurance and drivers' wages.

Co-operation of Electric Vehicle and Power Salesmen Recommended

The power salesman and the electric vehicle representative are in the same field, dealing with the same customers and, although the fact is not fully appreciated by either of them, have an interest in common. In the report of the electric vehicle and power sales bureau co-operation committee, E. S. Mansfield chairman, a study and suggestions have been made of ways and means by which each interest may benefit itself by working in sympathy and co-operation with the other. It is not to be expected that the power salesman will devote all of his time to the introduction of electric vehicles, but he should know something about electric transportation, the range of its efficiency and its relative economy.

Managers of some companies believe that the conditions in their localities are such that electric vehicles cannot be operated successfully, or that the amount of transportation is so small that it would not pay to appoint an electric vehicle power salesman. Even so, it would be better to have some one knowing the facts and conditions to notify prospective customers of them.

The electric vehicle representative cannot expect the fullest amount of co-operation from the central station unless he in turn shows the same spirit. A little study on his part, together with a conference with the central station, will put him in a position where he can tell the "prospect" a simple story which can afterward be confirmed by the power salesman. A little knowledge may enable the electric vehicle man to point out how by combining his charging load with other power he can obtain a better rate.

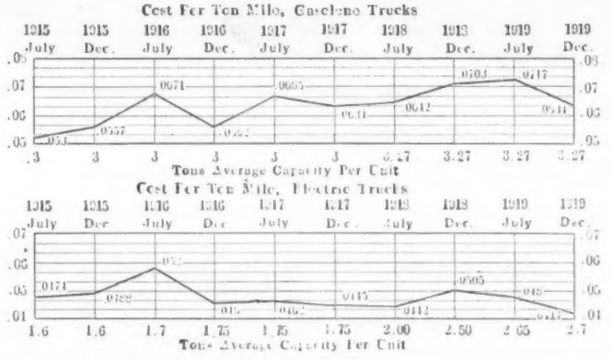
Lack of Transportation Engineering Education

While the large quantity of operating-cost figures collected by the transportation engineering committee, of which F. M. Feiker is chairman, are not comparative to the extent that accurate cost facts could be deduced from them, still they indicate that the cost of operating the electric vehicle, taking all factors into consideration, is about one-half the cost of gasoline transportation for similar operating conditions.

The committee was of the opinion that the way to present the growing importance of both the commercial and the industrial electric vehicle in the transportation industry is to associate them in the first place with the larger problem of transportation and in the second place with the problem of electricity in transportation, with all of which the central station has an increasingly important relation.

In this connection the committee made a study of transportation education. A questionnaire was sent to most of the educational institutions of the country, the results of which showed a lack of any definite conception of transportation engineering as such, although in places there is elementary knowledge of the general subject.

While transportation engineering is the big thing, there is no crystallized definition of a transportation engineer and there is far from any crystallized sentiment as to how the prospective transportation engineer is to be trained. Although not laying down a



COMPARATIVE COSTS PER TON-MILE OF GASOLINE AND ELECTRIC TRUCKS

course in transportation, the committee felt that the subject could not be covered properly by the separate departments of a university taking it up from their own particular viewpoints. Rather should such a course be built up with the general subject in view, guided by an individual not tied by experience or sympathy to any one particular phase of transportation.

The report contains suggestions on transportation engineering from a number of universities together with requests for assistance regarding transportation engineering courses.

There are appended to the report the complete data received from the colleges in reply to the committee's questionnaire relative to instruction in transportation engineering.

The Electric Truck an Economic Necessity

In spite of several years of extremely keen competition with gasoline trucks, the electric truck remains an economic necessity in the transportation field, said C. A. Street, in a short paper on the subject of the electric truck industry. The proper application of the most economical machine is to use electric trucks for work within their capacity and gasoline trucks only for work beyond the capacity of electric trucks. Complete accurate operating cost records of large users of both gasoline and electric trucks prove that a 5-ton gasoline truck, operating an average of 40 miles per day, costs approximately $5 to $10 a day more than a 5-ton electric truck doing the same work.

The electric truck industry has not grown at the same rate as the gasoline truck industry, owing, possibly, to the enormous advertising and sales campaign carried on for years by the gasoline passenger car and truck interests.

Accounting Sessions

Chairman R. W. Symes opened the first accounting section on Thursday afternoon, the second session being held the following afternoon. At these times chairmen of the following committees presented their reports:

Credits and Collections, David Darlington chairman.
Classification of Accounts and Accounting Relations with Other Associations, William Schmidt, Jr., chairman.
Bonus Systems, H. A. Snow chairman.
Merchandising Accounting, C. W. Johnson chairman.
Accounting Service to Member Companies and the Monthly Bulletin, Frederick Smith chairman.
Motor Vehicle Records, G. P. Landwehr chairman.
Purchasing and Storeroom Accounting, W. F. Stevens chairman.
Federal Income Tax Procedure, H. E. Addenbrooke chairman.
Customers' Records and Billing Methods, J. D. Jacobus chairman.
Accounting Education, Douglass Burnett chairman.

WHILE the proposed Accounting Section of the National Electric Light Association is substantially the same in character as the existing Accounting Section, it is not possible to suggest a program for future work until the reorganization is carefully studied, Chairman R. W. Symes said in his address before the section. The work of the section will be considerably enlarged and its sphere of usefulness broadened by the new plan. Several of the accounting committees have been tentatively placed in the category of national or standing committees, and the work of such committees has been co-ordinated with that of like committees of other sections. With the proposed plans adopted another step in advance will be recorded and the work of the section should take an even more important place in the affairs of the industry.

328 Replies to Credit Questionnaires

Questionnaires sent out by the committee on credits and collections, David Darlington chairman, covering the methods employed in the credit and collection departments resulted in 328 replies from member companies. These replies showed that usually credits and collections are handled by a single department and credit requirements must be met before service is given; unpaid accounts must be settled up before customers can open new ones after service has been discontinued; exchange of credit information with other commercial houses is practiced by about 50 per cent of the companies; guarantees or deposits are required quite generally; discounts varying from 3 per cent to 20 per cent are given for prompt payment, and appliances are sold on the installment basis by most of the companies dealing in them.

Tabulated data from companies having fewer than 1,000 customers and companies serving more than 50,000 customers are given in the report, showing nature of billing, whether net or subject to discount, the percentage of collections received through mail, collectors, main and branch offices, percentage of deposits held based on monthly sales, number of collectors, percentage collected in calendar month in which billed and percentage of bad debts.

Standard Classification Soon to Be Completed

No stated meetings of the committee on classification of accounts and accounting relations with other associations, William Schmidt, Jr., chairman, were called or held during the year, but a large amount of correspondence has been conducted with the National Association of Utilities Commissioners, with the various state regulatory bodies and with the association heads of the Accounting Section. At a later date a conference will be held, and probably the matter of a national standard classification can be successfully adjusted at one sitting.

Opinion Divided on Efficacy of Bonus Systems

Bonus systems of increasing employees' remuneration are neither indorsed nor condemned in the report of the Accounting Section's committee on bonus systems, Harry A. Snow chairman. Of 133 large central stations surveyed, only twenty-four have bonus systems in use, although reports of nine bonus systems having been tried and discarded also were received. Wage plans of twenty concerns outside the electrical industry also were studied for additional data. Co-operation of employer and employee is essential to the success of any such plan, the report states, the primary object being to increase the efficiency and interest of the employee to the mutual benefit of himself and the company. Unfair advantage taken by either side must militate against the success of any such plan. In the appendix of this report actual details of bonus plans successfully in use in central stations are given.

Classification of Merchandising Accounting

The same classification of merchandising accounting has been retained by the merchandising accounting committee, C. W. Johnson chairman, that was submitted in 1917. A canvass of member companies as to their attitude in regard to the classification submitted, also a request for suggestions from them as to changes or additions that should be made in the accounts, brought out the fact that owing to the war and the general labor conditions of 1917 and 1918 member companies had not made use of the classification.

An index to merchandise accounting is proposed which consists of six main divisions, with subdivisions: (1) Revenue from merchandise sales; (2) cost of goods sold; (3) cost of installation; (4) selling expenses; (5) general expenses; (6) fixed charges. The smaller companies may desire to use only the main classification consisting of the six accounts. Those desiring more than the six accounts may use the first subdivision, of which there are twenty accounts, while the larger companies may avail themselves of all subdivisions. This extends the classification to a total of thirty-nine accounts.

Accounting Service to Member Companies

Since the previous report of the committee on accounting service to member companies, there has been a service department organized at the association headquarters in charge of F. W. Herbert, formerly a member

of the Public Utility Commission of the State of Colorado, who is to assist in the accounting service work. The work of the accounting service has been very extensive during the past year, and numerous inquiries have been received by the state representatives.

In connection with the work the committee sent out letters to the various state representatives calling for suggestions. One of the problems which came to light was in respect to the handling of accounts where the consumer put up the money for an extension with an agreement for a refund on a certain basis over a period of years. In a number of cases the utilities commissions have felt that since this property had been paid for by the consumer it should not have been carried on the property or construction account of the utilities until such time as the actual refund to the consumer had taken place. It is the opinion of the state representative who brought up this point that such an agreement was working a hardship on the utilities, for the utilities would not be able to earn a rate of return or a percentage for renewals and contingencies on such property.

It is the intention of the committee, of which Frederick Smith is chairman, to continue the effort to extend the scope of this work and to cover the states which at the present time have no representative.

Motor Vehicle Records Emphasize Need of Better Accounting

The efforts of the motor vehicle records committee, G. P. Landwehr chairman, have been concentrated on obtaining cost data on the interchangeable report which was recommended by the former committees. The results obtained by securing these figures, while of great value, proved conclusively that a new campaign must be started to have all companies consider their transportation department as a separate unit of the electric system. The committee is to continue the collection of data during the coming year.

Systematic Keeping of Purchase-Price Records

In the development of a system for keeping purchase-price records the committee on purchasing and storeroom accounting, W. F. Stevens chairman, holds that only those prices which have some potential value should be recorded. Instead of recording all prices a division should be made taking out all of those that are special or where there is a lack of description. The responsibility of maintaining the established standards of completeness should be delegated to one person. Data recorded should be as follows: Date of purchase order; number of purchase order; name of vendor; gross discount—net price; quantity.

Purchases of supplies may be grouped under the following heads: (1) Contracts; (2) formal orders; (3) emergency orders; (4) petty-cash transactions. The subject of emergency orders is one which the committee has taken up in considerable detail. With few exceptions the emergency order has found a useful place only where the purchasing organization is centralized at a distance from the stock centers. Its legitimate field is where a company has taken over smaller ones in surrounding towns. It is often necessary in this case to develop some form of local purchasing. The committee has gone into a detailed system of handling orders of this kind.

Inventory procedure is another subject which has been investigated with regard to its purpose, routine, operations, time of taking, responsibility for results, final report, study of errors of storehouse operation, precision of results and standard methods of comparison.

Information on Making Tax Returns

In carrying out its work in giving member companies suggestions as to pitfalls in the federal income tax requirements, the committee on tax procedure, H. E. Addenbrooke chairman, prepared and sent out three papers. The subjects covered were "Accounting as Affected by the Federal Income and Excess Profits Tax Laws," "Questions Affecting Invested Capital and Net Income" and "Suggestions Affecting Consolidated Returns." A lesson was also prepared for the advanced accounting course on the general subject of tax laws and regulations.

Customers' Records and Billing Methods

Depositing cash in bank with the least delay and causing the customer's account to reflect accurately as soon as possible the fact of his payment are essential to a good system of handling cash receipts, it was stated in the report of the committee on customers' records and billing methods, J. D. Jacobus chairman. Elimination of the peak in balancing of consumers' ledgers has been solved by sectionalizing the ledgers either by the routes by which they are read or by some other convenient method and balancing them as units at different times during the month, unit balances being taken when the unpaid bills are at a minimum, usually just prior to the billing period.

Rendering bills to residential and apartment-house customers at bimonthly or quarterly periods has been tried out in two instances, and the plan adopted has been in operation more than a year, with results so satisfactory that it is improbable that either company will revert to monthly billing. The saving in bimonthly billing has been approximately 50 cents per customer and under quarterly billing 60 cents per customer.

A system of combined billing and ledger posting by machine for customers' account has been adopted by a number of companies and has proved to be a great saver of time and labor.

In the discussion on the report E. J. Fowles of the Commonwealth Edison Company said that machine billing, if properly applied, would effect great simplification of customers' account, but that continuous meter reading and monthly and quarterly billing have not given universal satisfaction in the territory of the Commonwealth Edison Company. Mr. Schmidt, Jr., said that bimonthly and quarterly billing had greatly reduced the number of complaints, but that the expense is not justifiable. He estimated that from $350,000 to $400,000 additional working capital is required for bimonthly billing.

Restrictions on Subscriptions to Accounting Courses Removed

The committee on accounting education, Douglass Burnett chairman, states that prior to Oct. 1, 1919, restrictions to the elemental and advanced accounting courses were limited to member companies, but owing to the request for the use of these courses by allied industries and educational institutions these restrictions have been removed. The advanced course is now at a stage where twenty-five lessons are available.

Raising Economy in Prime Mover Practice

Increased Attention Is Directed Toward Economy in Power-Plant Practice as Shown by Prime-Mover Report at N. E. L. A. Convention—Problems of Burning Low-Grade Fuels, Oil Engine and Hydraulic Practice Are Studied

RISING costs of fuel and labor have caused central-station engineers to attack, with new energy, the problem of increasing over-all plant economy. Progress in burning low-grade fuel is reported by N. A. Carle, chairman of the National Electric Light Association committee on prime movers, and it is stated that Diesel oil engines have been perfected to such a degree that they may be profitably considered for installation in central stations. Manufacturing companies are said to be correcting difficulties in steam turbines and boilers which were constructed during the war period. Problems arising out of the interconnection of steam and hydraulic stations are being scrutinized for the purpose of obtaining maximum economy in the whole system.

Operating records of single-shaft turbines, according to the report, have not been entirely satisfactory, and several additional turbine failures have occurred during the year. An analysis of the data indicates trouble due to vibration of the wheel structure causing fatigue cracks. Trouble has been accentuated in the disk where sharp tool marks or rough surfaces are present or holes in the wheel are drilled for balancing purposes. Considerable investigation is still necessary on the subject of vibration of wheels before all the facts can be known and the designs can be completely guarded against this trouble. Records of units manufactured since the last report indicate that 30,000-kw., 1,800-r.p.m., 60-cycle, and 35,000-kw., 1,500-r.p.m., 25-cycle, are the present maximum standard sizes of single-shaft, single-barrel units for large installations.

Starting Large Steam-Turbine Units

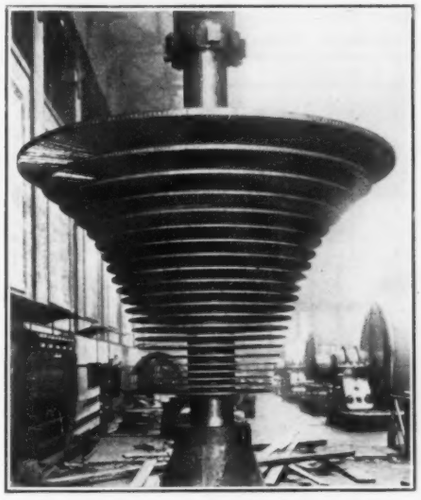
Elimination of danger from temperature changes in starting large turbines from the cold state cannot be accomplished by hard and fast rules. Generally, a partial vacuum of 15 in. to 20 in. (380 mm. to 500 mm.) is maintained during the warming up of sufficient steam to turn the unit at not more than 10 per cent of its speed, the safe minimum line being given as twenty minutes for units of 20,000 kw. capacity and thirty minutes for units of 30,000 kw. Application of load at a rate for these sizes not exceeding 1,000 kw. per minute seems to be the general rule.

Serious damage in some instances to the casings of large turbine units has resulted from contraction and expansion of steam lines. Emphasis is laid on the necessity of making the steam lines sufficiently flexible and providing anchorages in such positions as to prevent transmission of strains to the turbine casing.

Careful selection of oil for turbine use is pointed out as a necessity to eliminate troubles due to the tendency of manufacturers toward operation of lubricating oils at higher temperatures and the deterioration caused by contact with air and water occurring under working conditions. Current practice calls for frequent treatment by means of purifying and filtering devices. Two methods of treatment are generally used—the continuous system and the batch system, the first consisting of continuous circulation of the oil through the treating apparatus, while under the second the oil system is drained at regular intervals for treatment and replaced with a fresh supply.

Limitations in the Use of High Vacua

In connection with condensers and auxiliary air-removal devices it is reported that there has been no radical change in apparatus of this type. Operating engineers are, however, realizing more and more the possibility and advantages of high vacuum and are more systematically correcting faults of both the prime mover and condenser equipment to obtain this end.



ROTOR OF A 35,000-KW. TURBINE

The tendency toward large sizes of boiler units has continued during the past year. Units of 1,000 hp. to 1,500 hp. and over are quite common in central-station practice. The committee calls attention to the fact that with boilers made under war and post-war conditions troubles have developed due to faulty shop work. The Uniform Boiler Law Society reports that nineteen states and a large number of country and municipal bodies have adopted the code to date. Manufacturers report no radical changes in design features, but their statements do indicate a general tendency to turn out boilers of higher rated capacity, without increasing materially the maximum pressures now in general use.

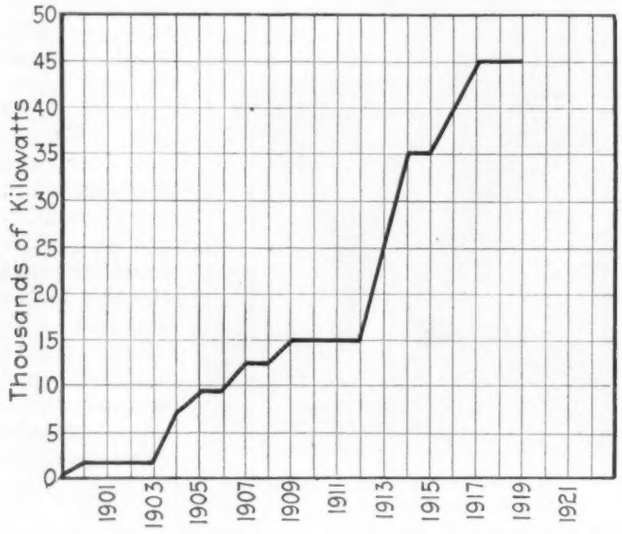
Little Trouble Has Developed with Superheaters

Perhaps the most important fact brought out by a questionnaire on superheaters was that, considering their difficult location and the delicate nature of their work, superheaters are causing a surprisingly small amount of annoyance and concern to the operators.

The tendency toward larger boiler units and high boiler ratings has emphasized the need for providing boiler-feed water which is free from incrusting solids and other troublesome ingredients. Although water treating plants are occasionally an absolute necessity on account of unfavorable feed-water conditions, they are more often merely a means whereby better over-all results are obtained. The use of evaporators for supplying make-up water for generating stations has come into use only during the last four or five years. Undoubtedly, high boiler ratings and large-sized boiler units have been largely instrumental in bringing about this development.

Because of the increasing adoption of higher steam pressures and the feasibility of constructing steel economizers to meet this condition, special interest attaches to this type and to the efforts being made by the manufacturers to eliminate troubles from internal corrosion that have been experienced both in this country and abroad. It is the committee's understanding that if the temperature of the water entering the steel economizer is kept up to 200 deg. F. (90 deg. C.) serious corrosion troubles are not likely to occur, as the heating to this temperature effects the release of most of the entrained air, to which the corrosive action appears to be largely due.

Lignite and sub-bituminous coals such as occur in Washington, Montana, Wyoming, Colorado, Dakota and Texas are commonly burned on hand-fired grates; less often on stokers. Using hand-fired grates with a surface considerably more generous than is the practice with bituminous coals, boiler ratings of 100 per cent and



GROWTH IN SINGLE-SHAFT TURBINE RATINGS

sometimes higher are obtained. The combined efficiency is ordinarily below 60 per cent except with the very best operation.

In mechanically stokered plants, and especially with forced-draft stokers, much higher boiler ratings are obtainable than with hand firing. With coals of the sub-bituminous character boiler outputs up to 300 per cent of normal ratings may be realized, and with lignites as much as 250 per cent is possible. Results reported with various types of equipment are given in the table. These results are not necessarily the best obtainable. As far as regards boiler capacities developed the figures probably give fairly accurate ideas of what may be expected at present.

INTEREST IS SHOWN IN POWDERED FUEL

The past year has witnessed an increased number of plants installed to burn powdered coal and a quite rapidly growing interest on the part of engineers in this development. The handling of powdered coal in large quantities has been successfully carried on in steel plants and cement mills, the coal being transmitted for a distance as great as 2,000 ft. (600 m.) from the powdering plant. On the other hand, several companies are now placing on the market unit pulverizing equipments, one or two units being installed for each boiler. So far as the mechanical details are concerned, either the centralized powdering plant or the unit system seems to be highly satisfactory.

It should be noted in general that the overload capacity of boilers equipped with powdered-coal burning devices is not as a rule so high at present as the figures that can be obtained when using underfeed stokers. This question of overloads will undoubtedly be worked out, however, as it is simply a matter of proportioning furnace volume to boiler heating surface. In old installations the space available in changing over from stoker equipment to powdered-fuel equipment is not sufficient to give the necessary furnace volume. This is a limitation which is inherent in the old apparatus, however, and not in the system.

In connection with the increasing use of oil it might be pointed out that properly designed furnaces for burning powdered coal are also very well adapted for burning oil, thus giving a flexibility of fuel supply not easily attained when using stokers. The powdered-fuel equipment also makes available certain low-grade fuels that cannot as a rule be burned economically on stokers.

One of the questions which has been passed over too lightly by both manufacturers and users of this equipment is that of the ultimate disposal of the fine ashes which now pass out of the stack. If the use of pulverized fuel is extended, municipalities will undoubtedly pass ordinances to eliminate the ash nuisance.

TESTS ON BOILERS BURNING LIGNITE

Test No.	1	2*	3	4	5	6	7	8	9
Source and kind of fuel	North Dakota (Wilton 6-in. lump) lignite	Bear Creek Wyoming sub-bituminous	Bear Creek Wyoming sub-bituminous	Texas lignite	North Dakota lignite	Colorado sub-bituminous	Monarch Wyoming screenings lignite	Texas lignite	Texas lignite
Heat value per pound as fired, bituminous	6,700	9,400	9,400	7,100	7,100	9,200	7,000	7,100	7,200
Moisture, per cent as fired	37	15	15	33	34	23	33	34	34
Make of boiler	Stirling	.....	.....	Edge Moor	B.&W.	Connelly	Stirling	Edge Moor	Edge Moor
Boiler heating surface, sq.ft	2,500	.....	.....	5,900	6,000	7,500	2,000	5,200	5,200
Make of stoker	McClave grate hand-fired	Chain grate	Chain grate	Coxe	Westing-house	Westing-house	Jones	Taylor	Taylor
Stoker size	68 sq.ft.	.....	.....	10 ft. 9 in. x 17 ft.	Seven-retort	.....	Two-retort	Seven-retort	Seven-retort
Duration of test, hours	7	8	8	4	7	†500	8	7	8
Per cent of boiler rating	150	210	160	135	140	.....	75	155	195
Coal per square foot of active grate surface, lb. per hour	45	38	28	34	47	.....	.....	.....	.....
Coal per retort, lb. per hour	.....	.....	.....	.....	860	.....	530	770	1,060
CO_2, per cent	.....	13.0	12.5	8.5	13.5	.....	.....	12.0	14.0
Flue gas temperature, deg. Fahr	460	610	510	520	470	.....	460	550	600
Equivalent evaporation from and at 212 deg. per pound coal as fired, lb	4.0	.....	.....	4.4	4.7	.....	4.9	5.1	4.7
Combined efficiency, per cent	60	75	75	60	64	65	69	70	64

*ELECTRICAL WORLD, Jan. 10, 1920.

† Service test on four boilers. During same period there were 340 banked boiler-hours.

Figures of oil production and consumption for the past year indicate that the United States is becoming more and more dependent on imports of oil to meet the rapidly increasing demand. The requirements of oil-burning ships and the improvements in the processes for converting heavy oils into gasoline are responsible for the diminished supply and poor quality of the oil available for general use as fuel. The tendency of oil-supply companies is to fix the price of oil at what the traffic will bear without any particular reference to the cost of production. For this reason it is difficult to see how an adequate supply of fuel oil at reasonable prices can become available for central stations until imports of oil from Mexico reach such proportions as to occasion a sharp decline in the market price.

On account of the recent difficulties in obtaining coal it has been urged that a more careful study of the shape of the storage piles of coal be made, not so much of the height as of the projected area, with a view to increasing the amount which can be crowded into a given space. Thus, circular piles in a row would contain less coal than one rectangular pile of the same length. The plea that small piles reduce the probable fire losses should not be taken seriously. At the first sign of heating in the rectangular pile the hot spot can at once be removed by cutting the pile at right angles.

The uniformly frozen state of coal in cars received by plants during the strike period and for a considerable time afterward demonstrated the very great need for comparatively cheap apparatus for breaking up such fuel. All the old-time expedients of pick and shovel and steam were brought into play, and while plants as a whole were able to survive, it was only at the expense of considerable labor and worry. One piece of machinery for unloading purposes which is comparatively new is manufactured by the Robbins Conveying Belt Company and is shown in the accompanying half-tone illustration. It consists essentially of a cylinder into which the car to be unloaded is run. Suitable clamping devices are provided to hold the car in place. The cylinder is then revolved and the coal allowed to run out.

The past year showed increasing use of indicating and recording instruments for turbine and boiler rooms. The wider use of these devices has been justified by the savings realized since their introduction. Among the more important points brought out by the committee's investigation are the need of a reliable and reasonably cheap pyrometer, the adoption by some companies of meters on boiler blow-down lines, and the substitution of self-starting synchronous motors in place of clock mechanisms for instrument drive.

Moisture Condensation in Turbine Room

Suitable ventilation of the turbine room today requires ample ingress of fresh air to the generators and liberal facilities to conduct outside the turbine room in summer the heated air leaving the generators. In winter the under side of the turbine-room roof must be kept reasonably warm; at the same time care must be taken that the heated air coming in contact with roof iron work has a low moisture content. Roofs built of hollow tile or with some other kind of air space are freer from condensation than those composed of a solid concrete slab.

It appears to the committee that the stationary Diesel engine has now reached a point of development where no radical changes in design may be expected in the near future. The engine as now constructed embodies many improvements and perfections in design, so that in point of reliability, accessibility of parts for inspection, cleaning and repair it is far in advance of the early Diesel engine. Its regulation, either when operating alone or in parallel with other units—steam or Diesel—is perfectly satisfactory.

Experience has shown that it is preferable to build a high-speed engine having several cylinders of small size rather than to increase the cylinder size. In large sizes (over 1,500 kw.), however, the two-cycle type has proved successful, and it is the type adopted by two of the larger manufacturers.

It should be borne in mind, however, that the fuel consumption of a Diesel engine is practically uniform, regardless of size, in contrast with steam plants. Its advantage in fuel cost is therefore greatest in small sizes. On this account and because of the inherent advantages of the large steam turbines (small floor space, low attendance and repairs) no rapid increase in the maximum size of the Diesel engines installed in central stations is looked for.

MACHINE FOR UNLOADING FROZEN COAL FROM CARS

The fuel consumption of the Diesel engine is now guaranteed at 0.4 lb. to 0.5 lb. (0.18 kg. to 0.22 kg.) per horsepower-hour at full load and 0.5 lb. to 0.6 lb. (0.22 kg. to 0.27 kg.) per horsepower-hour at half-load. This represents a thermal efficiency of 34 per cent and is about one-third the fuel consumption of an oil-fired steam plant of equal size. It is a performance which does not leave much room for improvement. Any reduction in fuel cost will be accomplished by adapting the engine to use cheaper fuels. This point has received considerable attention recently, and fuel atomizers have been perfected to use the heavy asphalt-base oils of Texas, California and Mexico. However, the committee still recommends the use of better grades of oil even at a slightly higher cost.

Operators of Diesel-engine plants have come to realize that the qualifications of those in attendance on the plants should be considerably above those which have been required in the past.

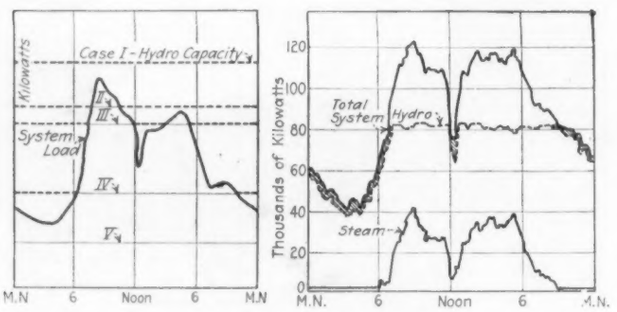
Single Waterwheels of 40,000 Hp.

The increased size of waterwheels, together with the larger number installed, seems to be the most important feature of the past year's development. Single wheels of approximately 40,000 hp. capacity have been installed

and much larger ones are contemplated. The growth of operating systems makes feasible this increased size of individual units. One large manufacturing company reports that it has totaled nearly 250,000 kw. in large hydro-electric generators (in units of more than 12,000 kw. each) started in the past year. While all of the large waterwheel manufacturers report this tendency toward larger units, yet there are a large number of smaller vertical direct-connected wheels being installed as additional or replacement units.

During the past year a new type of waterwheel has been developed by Forrest Nagler of the Allis-Chalmers Company. This is an exceptionally high-speed runner and was designed for low-head plants.

The Great Western Power Company of California has ordered, from the Allis-Chalmers Company, four 15,000-hp. tangential wheels built for operating under an effective head of 1,008 ft. (330 m.). These wheels contain twenty-one buckets, each 36 in. (90 cm.) wide and 24 in. (60 cm.) deep, and water is supplied from thirteen nozzles. They are to operate at a speed of 171.4 r.p.m. It may be of interest to state that several waterwheel manufacturers designed and recommended Francis-type wheels for this head at a speed of either



TYPICAL HIGH-FLOW LOAD CURVES

At the right are actual curves from the Baltimore system for Dec. 11, 1919. The steam plants furnished 386,600 kw.-hr. at 38 per cent load factor, while the hydro plants supplied 1,636,500 kw.-hr. at 83 per cent load factor.

600 r.p.m. or 750 r.p.m. The operating engineers, however, considered that the erosion on the clearance passages and gate mechanism might be rather severe when operating under a pressure of over 430 lb. per square inch (30 kg. per sq.cm.). This, coupled with the fact that such a wheel would require a turbine-type generator with smooth core field, which was not suited for charging conditions on their long transmission line, led them to choose the impulse wheel.

Automatic hydro-electric plants are receiving considerable attention. Several plants of this type have been built or rebuilt and are working very satisfactorily. These plants operate without attendants, and the gate openings and output are regulated, according to the water supply available, by means of a float control from pond level. These plants may be tied into a local power system or be run in connection with a steam station which takes care of the fluctuation of load and varying flow of stream.

The combined operation of hydro-electric and steam-electric generating stations has become a subject of vital interest to the central-station industry. It will be increasingly important in the future, since the marked trend toward interconnection will bring more and more steam plants into parallel operation with hydraulic plants and will make possible the development of water powers which cannot now be utilized economically. Yet intensive study of the subject is comparatively new. Individual companies and systems have made more or less careful analyses of their own conditions and problems, but there has been little information exchanged or published. These problems are outlined in considerable detail in the report.

Typical of the problem of combined operation of steam and hydraulic plants is that of load division. The problem is considered first from the point of view of a system operated for a minimum over-all cost. It divides itself naturally into two parts—high- or excess-flow operation and low- or deficient-flow operation.

By "high flow" is meant a flow which is more than sufficient to generate the system load up to the hydraulic capacity at a time when the excess flow cannot economically be impounded. There are five typical conditions of steam generation as illustrated by the load diagram as shown: (1) no peak steam generation, (2) single peak steam, (3) double peak steam, (4) all day steam and (5) twenty-four-hour steam.

Maximum hydraulic output will be obtained if the hydro plant generates the entire load during the off-peak hours and operates at maximum capacity during the peak hours. Theoretically, the hydro capacity lines in the figure would then also be the hydro load lines when they are below the system curve. This operation would give a minimum over-all operating cost. Actually it can never be entirely attained, unless there are no peak hours. It might be that such operation would increase maintenance cost at the steam plant more than it would decrease the operating cost.

Specific example is shown in the right-hand figure which gives typical high-flow load curves of the Baltimore systems. Energy generated by steam which might have been furnished by water power may, from the purely hydraulic point of view, be called "hydro losses" or "unnecessary steam generation" and is shown by the shaded area. Such steam generation may be divided into two classes:

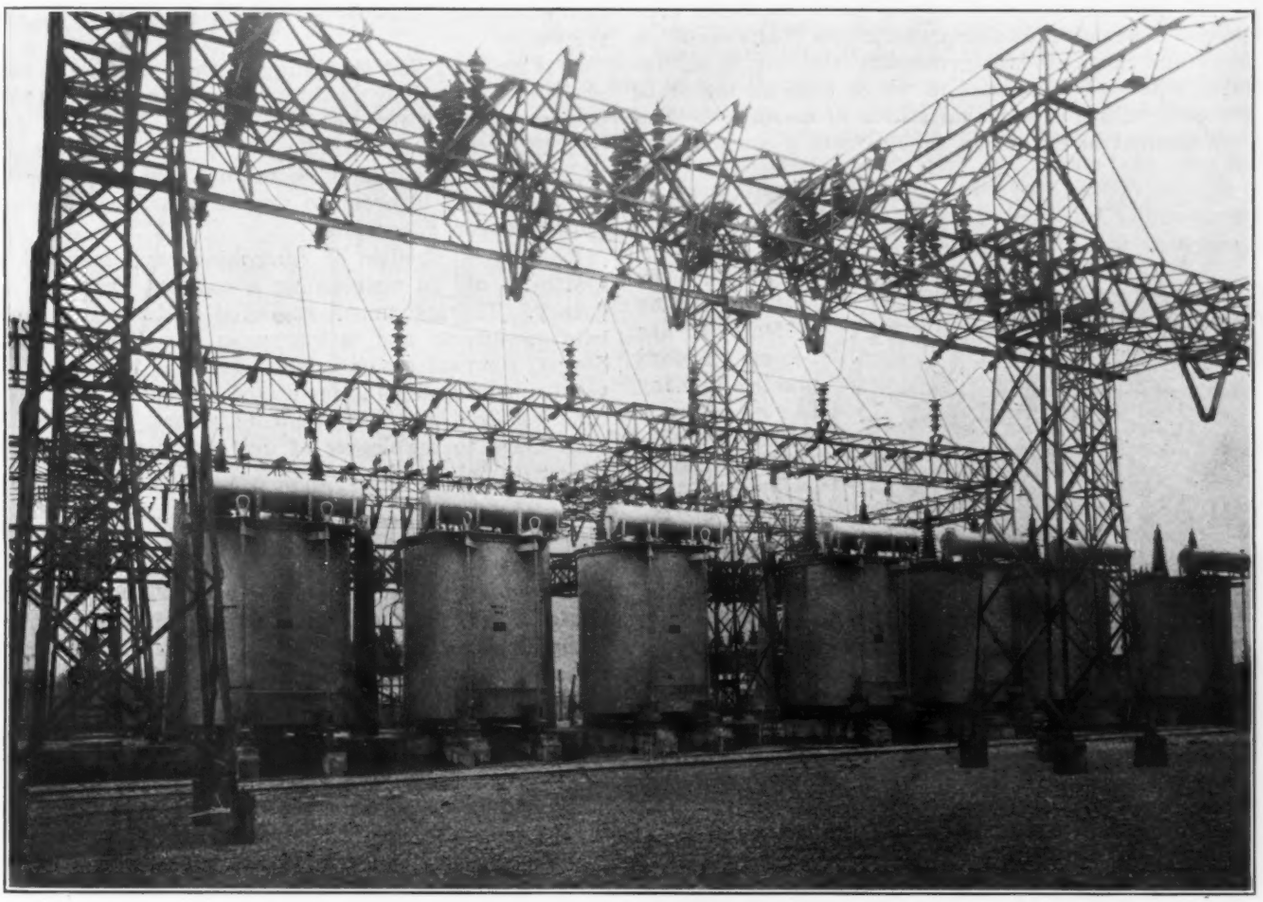
First—Steam generation for maintenance economy or safety of steam plant equipment, or for reliability of service. For example, in this case the "unnecessary" steam generation is due to the operation of a 2,000-kw. reciprocating engine unit in the early morning and late evening off-peak hours for purely steam reasons, or to carry minimum load on 20,000-kw. steam units.

Second—Unnecessary steam generation caused by faulty governing or load dispatching.

When a steam central-station company first takes energy from a hydro-electric plant there is usually a certain distrust of the reliability of the hydro service, and various measures have been adopted to enable the steam plants, acting as standby plants, to pick up a large portion of the load in the shortest possible time. This safeguarding of the reliability of service is both natural and justifiable until the hydro service has proved its reliability. It has been proved, in recent years particularly, that the individual hydraulic prime mover is more reliable than the individual steam turbine. Hydraulic prime-mover troubles have been rare as compared with those of steam turbines. The present-day single-runner vertical-type waterwheel-driven generator equipped with a Kingsbury bearing seems to give almost perfect continuity of service. It has nearly always been found that the hydro service can be restored before the steam plant can pick up a large proportion of the load even with a number of boilers held ready under "hot bank."

Present Status of Electrical Apparatus

Many Systems Are in Need of General Replacement and Maintenance Work, and N. E. L. A. Committee Points Out Dangers in Its Postponement—Standardization Appears to Offer Best Opportunity of Bringing Down High Cost of Equipment



LARGE OUTDOOR SUBSTATION WITH CONSERVATOR-TYPE, 10,000 KVA., 66,000/120,000-24,000/6,600 VOLT TRANSFORMERS

ONE of the very important points brought out in the report of the electrical apparatus committee of the National Electric Light Association at the Pasadena convention was that practically all utilities are suffering to some extent as a result of war-time curtailment of their construction programs and that nearly all companies find themselves now, at a time of very high prices, in a position where a gread deal of renewal and reconstruction work is absolutely necessary in order to restore the pre-war reliability of service. The committee further points out the great value of standardization which has already been accomplished, largely through the instrumentality of the N. E. L. A., and it is estimated that already a saving of several million dollars has been effected by the industry as a direct result. Further practical standardization of a nature not to impede development should be constantly aimed at.

The work of the committee during the last year, under the leadership of R. F. Schuchardt, chairman, was so organized as to encourage activity in all parts of the country by means of a district plan of organization. The country was divided into six districts, the members in each forming the district sub-committee with its own chairman. The greatly shortened travel distance required of members and the attention which could be given to local problems by this plan of organization were the two main advantages sought.

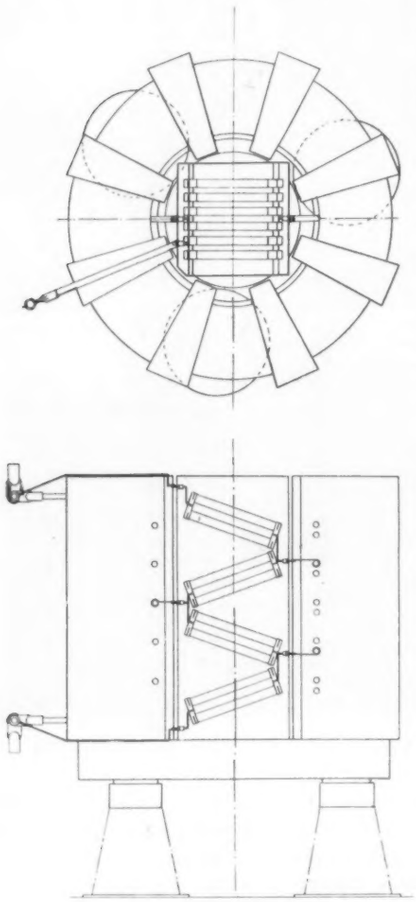
A feature of the report is that the use of automatic substations for light and power as well as for railway service is rapidly increasing. Outdoor substations are also said to be growing in favor. Considerable progress is reported in the matter of the proposed rules of the National Electrical Safety Code through co-operation between the Bureau of Standards and the electrical apparatus committee.

In dealing with generating stations it was pointed out that the condition of heavily loaded systems and the consequent inability to disconnect units from the system in many instances for proper cleaning and inspection still exists to a large extent, but a much smaller number of generator failures and fires have been reported during this year. Additional evidence of the value of balanced-relay protection has been obtained in the case of a 12,000-kw. unit which failed owing to a field breakdown, causing a short circuit in the armature winding. The balanced relay promptly operated and the damage was limited to slight burning of the armature and field windings, which were easily and quickly repaired. Installations of fire-extinguishing equipment

are divided in a fairly even way between those providing for use of water and those providing for use of steam.

CONTROL AND EXCITATION SYSTEMS SHOULD BE SEPARATE

The general subject of excitation is receiving considerable attention at the present time. The trend in large and medium-sized generating stations is unmistakably toward a practice in which each generator is provided with an individual source of excitation. The arrangement of excitation supply from a common bus is open to the objection that trouble at any point may seriously disturb the entire excitation system. It has become standard practice in many large steam stations to install generators equipped with an exciter on the end of the shaft. On several large systems employing individual excitation, particularly in metropolitan districts, storage batteries have been provided for emergency excitation in addition to spare exciter capacity. Until recently it has been common practice to operate control systems from the excitation busbars. Many large companies have now entirely separated these systems because of the effect of disturbances produced in the control system by trouble in the excitation system. Among the advantages of separating these systems are these: The control system is not rendered inoperative by trouble on the excitation system, grounds on either the excitation or control system do not affect the other, and burn-out of control lamps by high voltage momentarily impressed by disturbances on the excitation system and consequent serious confusion in operation in time of trouble are prevented.



RESISTOR IS MOUNTED WITHIN REACTOR

Regarding current-limiting reactors, the committee states that too much stress cannot be placed upon the importance of careful design and construction which will give the utmost reliability. There have been instances of reactor failures at times when their protection was most needed, but these have resulted in improvement of design. The General Electric Company has during the past year developed a resistor arranged for mounting inside of the reactor and for connection across its terminals. The reactor is of the cast-in-concrete type with a separate resistor unit. The function of the resistor is to absorb the energy of high frequency oscillations which may be set up, thus preventing the high resonant voltages from being built up across the reactor and other inductive apparatus on the system.

It is reported that grounding of the neutral of three-phase systems solidly or through resistance has rapidly become standard practice throughout the country for both 25 cycles and 60 cycles. It is usual practice not to ground the neutral of more than one generator at the same time in order to prevent possible cross-currents between generators.

Recently a number of companies have installed a system to aid in maintaining a constant average frequency. The instrument employed contains two separate movements and is known as the Warren Clock. Several companies have advised that the paralleling of two or more systems is facilitated because of the lesser time required for synchronizing where frequency is maintained to the degree of uniformity which is possible with this clock.

CIRCUIT-BREAKER RATINGS NOT YET SATISFACTORY

The work of the sub-committee on oil circuit breakers related to the methods of rating and the factors influencing interrupting capacity and to the general practice with regard to operating all circuit breakers under abnormal conditions and with regard to periodic inspections. The present method of rating the interrupting capacity of oil circuit breakers, as agreed upon and used by the several manufacturing companies, is to give the root-mean-square amperes which the breakers will interrupt twice, with an interval of two minutes between operations, and then be in condition to be closed and carry the rated current until it is practicable to inspect the breaker and make adjustments which may be necessary. The committee holds that the duty cycle adopted by the manufacturers is not representative of operating practice and recommends that manufacturers work toward establishing curves of ratings for each oil circuit breaker for any ordinary duty required.

Attention is drawn to the importance of educating primary or industrial customers, where it is the practice to have such customer provide the switching equipment, to appreciate the necessity of installing oil circuit breakers of adequate interrupting capacity when tied to the system of a large central-station company. It has been suggested that great advantages would accrue to the operating companies if the manufacturers could standardize the oil to be used in oil circuit breakers, and also in transformers. The time does not seem to be ripe, however, for such action on account of the experimentation which is being made to improve the quality of such oils. A noteworthy improvement has been made during the past year in the design of oil-circuit-breaker contacts. Some contacts in the past have been so designed that the mechanical stresses of heavy currents tended to force the contacts apart, whereas some present designs utilize the mechanical stresses to force the contacts more firmly together.

The transformer standards prepared by the committee last year have been reviewed after a year of use, with the result that only one change is recommended;

that is, that the minimum standard size be changed from 25 kva. to 37½ kva. for the 33,000-volt class. It is said that these standards have resulted in holding down the price increase of transformers, which would have otherwise been 30 to 40 per cent higher.

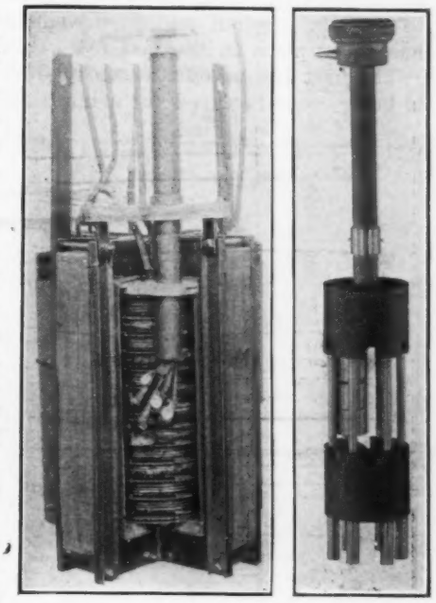
The principal improvements to eliminate the possibility of explosions and fires in transformers have been the removal from above the oil surface of unshielded conductors with their corona hazard and the discontinued use below the oil level in tank construction of solder or other materials of low melting point. Further precautionary steps have been taken recently by at least one large manufacturer in the development of tank construction in which the tank is completely filled with oil. A small auxiliary tank is provided above the main tank to which it is connected. The oil extends up into this smaller tank and thereby prevents the effect of varying level due to temperature changes from reaching the transformer.

The largest single-phase power transformers developed so far consist of a 70,800-kva. bank of transformers made up of three 23,600-kva. single-phase units, to step up from a delta generating voltage of 11,500 volts, 60 cycles, to a star line voltage of 66,000 volts or 132,000 volts. These units are of the shell type, having a temperature rise of 55 deg. C. at full load, and the guaranteed efficiency at full load is 99 per cent. The height of the tips of high voltage bushings is 22 ft. (6.7 m.) and the largest floor space dimensions of each unit lie within a circle whose diameter is 10 ft. 3 in. (3.1 m.).

A ratio adjuster has been devised to facilitate the changing of taps on transformers. Its use eliminates the necessity of links or connectors on the connecting boards for making tap changes and also of bringing the tap leads an appreciable distance from the coils. Another new development is the alternating-current network protector, which has been improved in construction as compared with earlier devices. The function of this protector is to disconnect automatically on both primary and secondary sides a defective transformer feeding an alternating-current network, so that the current which otherwise would be supplied by the network to the internal short circuit in the defective unit will not blow the fuses of adjacent transformers.

Both the large manufacturing companies have recently developed apparatus for indicating the hot-spot temperature of the transformer windings. The Westinghouse company has developed an indicating thermometer of the dial type which will indicate directly the approximate hot-spot temperature of the windings in a transformer under any conditions of load. The essential parts of the device are shown in the illustration. The actuating element of the outfit is a metal bulb placed in the hot oil of the transformer. Connecting the bulb to the instrument is a small copper tubing inclosed in a flexible armored tube for protection. The bulb is filled with a fluid whose expansion and contraction with changes of temperature cause the needle of the instrument to indicate the temperature. Surrounding the bulb is a heating coil which is connected through a current transformer to one of the windings of the transformer whose temperature is to be measured. This heating coil therefore carries at all times a current which is proportional to the load current of the transformer. The General Electric Company has developed a temperature indicator consisting of a temperature coil or resistance element inserted in the transformer winding and electrically connected to an indicating instrument external to the transformer.

Reports from various districts this year indicate a very noticeable activity not only in the amount of consideration given to the subject of automatic substations at the present time, but also in the purchase of equipment for actual installations. It is unlikely that the automatic substation will entirely supplant the substation with attendants. It is suggested, however, that careful thought be given to making all additional substations of the automatic type and to installing automatic and semi-automatic control features on equipment in existing stations where attendants are employed. There are several contributing factors making this desirable, among which may be mentioned (1) increasing cost of operating attendants, due (a) to increases in operators' wage scales, (b) to shortening of the hours of work; (2) increasing value of real estate in densely populated area; (3) greater rapidity in the restoration of service following a system interruption where automatic equipment is used. By the employment of automatic equipment it becomes possible to install relatively small units in centers of load areas, with relatively small investment in the high-tension feeder supplying the equipment and with comparatively small investment in feeder copper for



TRANSFORMER AND RATIO ADJUSTER FOR 33 KV.

COST OF AUTOMATIC SUBSTATION EQUIPMENTS

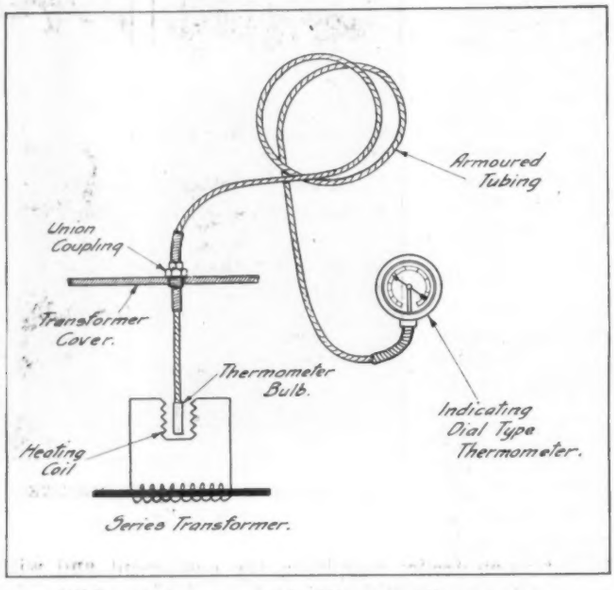
Approximate price per kilowatt (f.o.b. cars manufacturing plant), including converting equipment and control

Type	Capacity	Price
25-Cycle equipments:		
Booster converter, 240/300 volt, d.c., oil-cooled, three phase transformers, 13,200 volts	At 250 volts	
	550 kw.	
	750 r.p.m.	$27
Booster converter, 240/300 volt, d.c., oil-cooled three phase transformers, 13,200 volts	1000 kw.	
	500 r.p.m.	40
Booster converter, 240/300 volt, d.c., oil-cooled, three phase transformers, 13,200 volts	2000 kw.	
	300 r.p.m.	31
Shunt converters	500 kw.	
	750 r.p.m.	24
	1000 kw.	
	500 r.p.m.	37
60-Cycle equipments:		
Booster converters, 240/300 volt, d.c., three-phase, oil cooled transformer, 13,200 volts	500 kw.	
	1200 r.p.m.	$23.50
	1000 kw.	
	900 r.p.m.	35 to 37
	1000 kw.	
	720 r.p.m.	35 to 37
	2000 kw.	
	400 r.p.m.	27
Motor-generator set, shunt wound, 275-volt generator, 13,200-volt motor	1000 kw.	
	720 r.p.m.	31
	1800 kw.	
	514 r.p.m.	29

carrying the output from the machines to the load. Herewith is a tabulation of price per kilowatt of converting equipment of various characters for 25 cycles and 60 cycles, which is generally representative of the cost in November, 1918, including the converting equipment, the transformer where required and all necessary alternating-current and direct-current control and switching equipment for full automatic operation of the unit.

While the foregoing relates specifically to direct-current substations, it applies also to alternating-current distributing substations, particularly those of the transformer type where power is reduced from the transmission voltage through suitable transformers and distributed at 2,300 or 4,000 volts. It may be said that the successful application of automatic features of operation to the substation is in a large measure attributable to the development and improvement in relays which has taken place in the last few years.

The first full automatic control for industrial service is being manufactured for a large company in Detroit.



TRANSFORMER HOT-SPOT TEMPERATURE INDICATOR

This control is to operate a 500-kw. synchronous motor-generator set in an outlying portion of the plant. The load during the period of small demand is carried by the central power plant. The automatic control operates when the local bus voltage drops below a certain point. The control is designed to start the motor from auto transformers in the usual manner, throwing on full voltage when the motor is in step.

The first full automatic substation for supplying current to a three-wire network is being manufactured for a large central-station company in Minnesota. This equipment consists of a 500-kw. synchronous motor-generator set. The generator is flat-compound for 250-volt operation and is equipped with balance coils for three-wire operation. In this equipment no effort is made to parallel voltages before connecting the direct-current end to the line. The field rheostat is set for the proper running voltage and left at that point, the compound winding taking care of regulation under changing load conditions. This equipment will be started by an indication of low voltage and shut down on low current. This machine will help out the network immediately surrounding its location up to half its capacity, at which point the feeder resistors will operate to shift the load onto the large substation some 2,000 ft. or 3,000 ft. (600 or 900 m.) away. Copper feeders of sufficient size to give 5 per cent regulation if supplied from the nearest existing substation would cost approximately $45,000 installed. The automatic substation complete, including the 4,000-volt supply cable, will cost approximately $32,000 installed.

In the report of the committee it is pointed out that many automatic substations are now being planned for various parts of the country.

The committee is of the opinion that generally greater consideration should be given to the use of outdoor substations. The operating engineers of several large systems now employing indoor-type high-voltage substations have expressed the opinion that they would now unquestionably favor the use of outdoor-type substations. Those companies which already have outdoor high-voltage substations seem to be thoroughly satisfied with their operation. Report has been made of an order recently placed calling for two 12,000-kva., three-phase, core-type, 60-cycle, self-cooled outdoor transformers mounted on trucks for location near a generating station to step up from a generated voltage of 4,500 to a transmission voltage of 27,000. The transformers will be designed to withstand without injury a short circuit for five seconds on the secondary windings with full voltage applied at the primary wide. There will also be provided a capillary-tube thermometer mounted on the transformer case and a thermostat the closing of whose contacts, at dangerous temperature, will ring an alarm in the switchboard attendant's room in the generating station. The transformers are reported to be the largest self-cooled units in the world.

STARTING LARGE SYNCHRONOUS CONVERTERS

In units of 1,500 kw. to 2,000 kw. and above the high-tension starting equipment is probably less expensive to install in the case of manually operated switches and much less expensive if electrically operated switches are employed in the high-tension connection, as compared with electrically operated switches in the low-tension connections. The elimination of the low-tension switches will materially simplify the arrangement of these connections and permit of considerable shortening of the leads. This alone may eliminate all difficulties from the reactance of the leads of high current capacity. Some experience data will be required before general recommendations can be made.

Regarding the development of iron-tube rectifiers for heavy service, two manufacturing companies gave reasons for the abandonment of development work on such units, which have not come up to early expectations.

The wireless telephone appears to offer considerable promise as a means of communication between important substations and generating stations of transmission systems covering large areas. It is said that experiments are being made with it in Montana.

Member companies are urged by the committee to incorporate the N.E.L.A. motor rules in their own book of rules and to send to the apparatus committee any comments or criticism they may have to make, especially regarding their experience with them in practice.

Developing the Electrical Possibilities in Arkansas

Sound Engineering Practice and Practical Ingenuity Combine to Reach Seasonal Loads That Give High Annual Load Factor

THE Arkansas Light & Power Company of Pine Bluff, Ark., is developing a territory that is particularly interesting from a central-station standpoint. On account of the unusual character of the loads available and the ingenious methods employed in making the construction economical and reliable, the problems encountered are different from those of most transmission systems. In the first place, the loads—that is, the important power loads—are seasonal; but at the same time the most important seasonal classes of power business come at different seasons of the year and are so spread out through the twelve months that one begins as the other leaves off, thus producing when taken together a satisfactory annual load factor. These loads are (1) the irrigation pumping load for the rice fields, which begins approximately the first of May and ends about the first of September; (2) the cotton-gin load, which begins about the first of September and ends about the first of January; (3) the cotton-seed-oil mill load, which begins about the first of September and ends about the first of May. The combination of these three loads, together with the ordinary commercial lighting and power loads, gives a fairly uniform load curve, with the exception of a small sag from the first of January to the first of May.

How Seasonal Loads Give Good Load Factor

Within the territory which the company can serve from its Pine Bluff central power station and transmission lines there are a considerable number of rice-farming installations that might be electrified. Fifty-one irrigation wells are now motor-driven, and these afford a connected load of 3,900 hp. The average area irrigated per well is 130 acres (5c. hectares). This requires an average discharge from these wells of 1,250 gal. (4,730 l.) per minute. The wells producing this volume of water generally operate against an average head of 90 ft. (27 m.). A few of these wells are of the open-pit type, but the larger percentage are bored wells with usually a 10-in. (25-cm.) casing. In all cases the wells are equipped with two-stage or three-stage vertical centrifugal pumps with efficiencies that range from 30 per cent to 70 per cent. These installations give an average demand of 45 kw. and consume an average of 47,500 kw.-hr. per well per season.

Within the territory which is served by the transmission lines out of the Pine Bluff central power station, as well as many of the towns controlled and operated by the company, there are numerous cotton gins. When these cotton gins are motor-driven the average installation is 60 kw. and consumes an average of 12,000 kw.-hr. in the ginning season. Sixteen cotton gins are now connected to the transmission line of the Pine Bluff central power station, making a total connected load of approximately 1,000 kw.

The mechanical equipment of cottonseed-oil mills is easily and satisfactorily arranged for electric motor drive, and these mills operate continuously from 12 o'clock Sunday night to 12 o'clock Saturday night, there being a very small difference between the night demand and the daylight demand. The average cottonseed-oil mill requires approximately 500 hp. to operate all of the machinery. Some of the mills are large, requiring up to 2,500 hp. The Pine Bluff central power station and transmission-line system have at present a connected

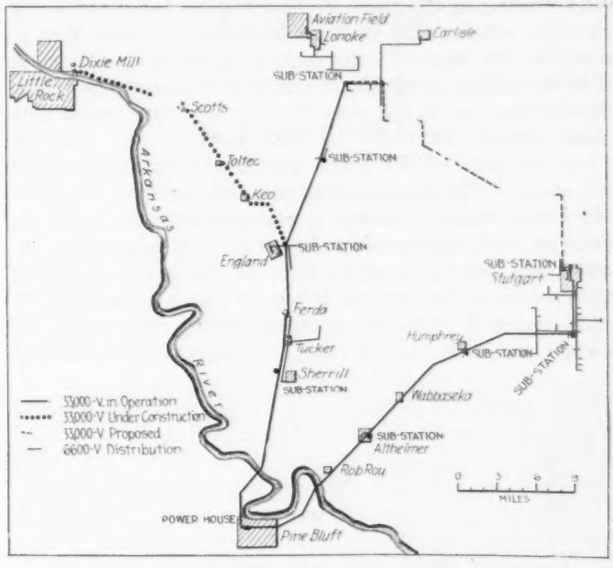


FIG. 1—MAP OF ARKANSAS COMPANY'S PROPERTY

load of approximately 2,000 hp., which with the cotton-gin load nearly balances the seasonal load furnished by irrigation pumping.

The combination of these enterprises with the usual town and city loads available produces a high annual load factor. This condition, however, does not change the fact that many of the individual transmission and distribution lines that are built cannot serve all three classes of load. The company calls 22,000-volt, 33,000-volt and 66,000-volt lines transmission lines and designates as distribution circuits lines operating at 13,200 volts, 6,600 volts and 2,300 volts. In regard to the engineering of these lines, William Crooks, chief engineer for the Arkansas Light & Power Company, said:

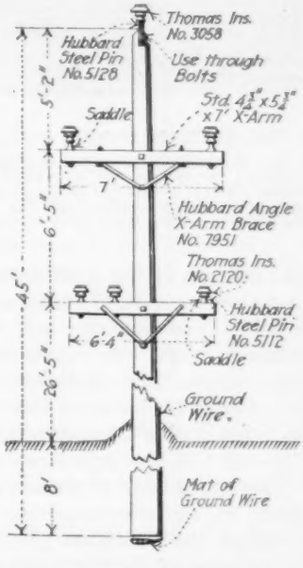


FIG. 2—STANDARD STRAIGHT-LINE CONSTRUCTION

The spacing on the 33,000-volt lines is adequate for 66,000-volt operation. The distance between wires on the two-wire side of the 22,000-volt arm is 18 in. The pole-top bracket is a success.

"There is similarity between transmission-line systems and railroad systems, since the 66,000-volt and 110,000-volt lines correspond to the main-trunk railroads and the 33,000-volt lines to branch-line railroads, with the 6,600-volt and 13,200-volt distribution lines as feeders. There is also quite an analogy between the philosophy of location of railroads and of transmission lines. The same general laws apply to both. The successfully located railroad is the one for which the location and type of construction were so selected that its earning

capacity is at a maximum, or, in other words, the location and type of construction should be selected so that the annual traffic per mile divided by the cost per mile is a maximum. This rule applies as well to the location and selection of the type of construction for a transmission line, except that it must be borne in mind that in selecting the type of construction there are no periods of interruption in which no traffic comes over the transmission line, as in the case of railroads, and ample provision should be made to take care of any possible future growth in the loads that the transmission line will carry. The term location in this sense is the general term, which includes a consideration of both the financial and engineering features and takes into account the feasibility of serving or not serving certain load centers in the general territory under consideration.

"In actually locating a transmission line upon the ground the most direct line between two determining

FIG. 3—TRANSMISSION LINE IN STREETS OF PINE BLUFF

Use is made of suspension insulators, while out in the country pin-type insulators are employed on the same line. This gives a high factor of safety in the city. This steel tower and another just like it were made from the latticework taken out of an old gas holder. The 205-ft. power-house stack is in the distance.

load centers is the most desirable. However, consideration given to ease of transportation during construction, policing, maintenance and repair may vary this procedure. It has been found just as advantageous to locate transmission lines with the aid of survey parties as it is to locate railroads in that way. To actually stake out the poles with a transit is the only way to secure perfect alignment in the pole line."

The application of these principles of line location are shown on the accompanying map (Fig. 1), which gives in detail the principal transmission system and shows the relation of the 6,600-volt lines which serve the pumping load to the system in general.

Of completed transmission and distribution line the company now has 102 miles (164 km.) of 33,000-volt line, 45 miles (69 km.) of 22,000-volt line, 38 miles (61 km.) of 13,200-volt line and 70 miles (112 km.) of 6,600-volt line. About 22 miles (35 km.) of 33,000-volt line is now under construction, and material for 42 miles (67 km.) in addition to this is on order. Other lines are contemplated. All 33,000-volt lines are built with spacings sufficient for 66,000-volt operation, as is shown in the drawings. The poles are spaced on 265-ft. (80-m.) centers, or twenty to the mile, for No. 4 copper or larger and 310 ft. (94 m.), or seventeen poles per mile, when No. 0 or larger steel-covered aluminum cable is used for conductors. The lines are sectionalized at

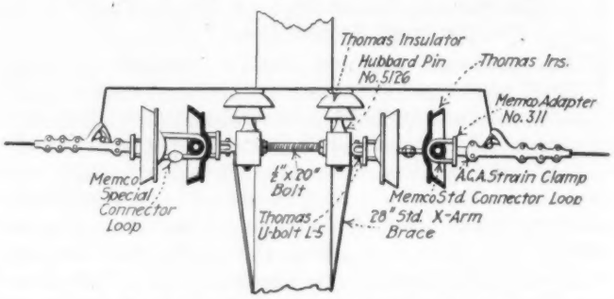


FIG. 4—DOUBLE-ARM DEAD-END PRACTICE

On 13,200-volt and 33,000-volt line one dead-end per mile is installed and the pole is guyed four ways with ⅜-in. guy wire.

intervals of from 5 miles to 10 miles (8 to 16 km.) by means of disconnecting switches designed to be opened only under no-load conditions. Some of the lines contain interesting special features which will be described in other articles. These include a long iron span or home-made towers, grounding precaution, special pole-top brackets and sturdy railroad crossings.

CLEARING A WOODED RIGHT-OF-WAY

It is the practice to be liberal in spending money for cleared rights-of-way. When lines traverse wooded country the terrain is cleared of all trees and underbrush

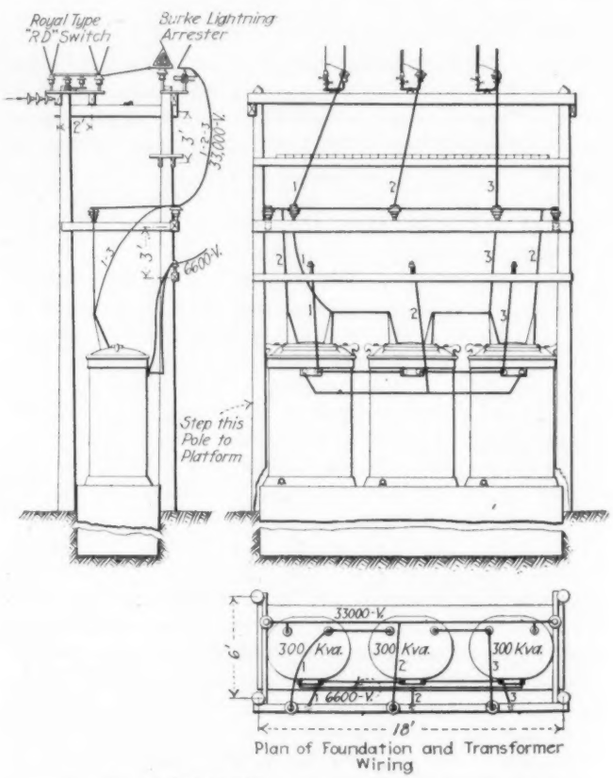


FIG. 5—33,000/6,600-VOLT STANDARD SUBSTATION

for 25 ft. (8 m.) on each side of the pole and in addition all trees that would come within 10 ft. (3 m.) of the line in falling are cut. Such lines cost about $28,000 a mile to construct in Arkansas without substations. Negro labor is usually employed in all construction.

These lines partly interconnect the company's fifteen plants and the thirty-six towns in which it operates.

The 6,600-volt lines are carried on 30-ft. (9-m.) poles spaced thirty to the mile. Flat-top construction and flat iron arm braces with 6-ft. (1.8-m.) arms and with No. 2, No. 4 and No. 6 conductor are used. These lines

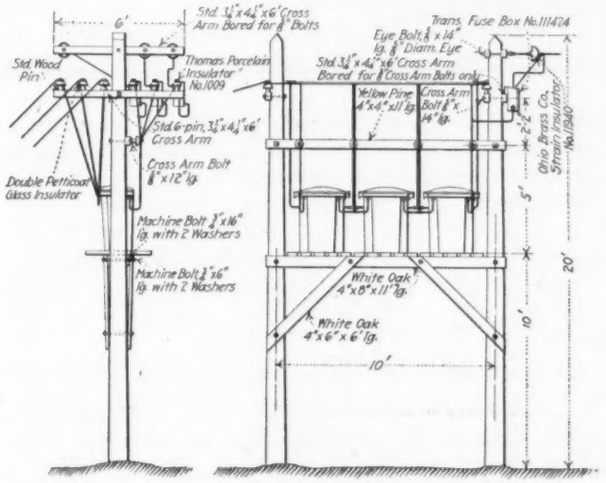

6'
Std. 3½"x4½"x6' Cross Arm Bored for ⅝" Bolts
Trans. Fuse Box No.11474
Eye Bolt ⅝"x14" lg. ⅝" Diam. Eye
Std. Wood Pin
Thomas Porcelain Insulator No.1009
Std. 3½"x4½"x6' Cross Arm Bored for ⅝" Cross Arm Bolts only
Yellow Pine 4"x4"x11' lg.
Cross Arm Bolt ⅝"x14" lg.
Ohio Brass Co. Strain Insulator No.1340
Std. 6-pin, 3½"x4½"x6' Cross Arm
Cross Arm Bolt ⅝"x12" lg.
Double Petticoat Glass Insulator
Machine Bolt ¾"x16" lg. with 2 Washers
Machine Bolt ¾"x6" lg. with 2 Washers
White Oak 4"x8"x11' lg.
White Oak 4"x6"x6' lg.
10'
2'-2"
5'
10'
20'

FIG. 6—6,600/220-VOLT STANDARD SUBSTATION

This is the type of substation which is used on the premises of rice farmers. It is designed as a safety-first installation.

are sectionalized with cut-out boxes carrying removable fuses and Burke horn gaps. Standard substations have been designed for 33,000/6,600-volt transformation and for 6,600/220-volt installation. Both of these types are illustrated, the latter being the one commonly found on rice farms when pumping motors are served. In this case particular attention was given to designing the 6,600-volt side so that a man on the platform would be in very little danger of coming in contact with the 6,600-volt circuits.

Electric Power for Ferro-Alloy Plants

THE cost and availability of electric power for electrometallurgical work is a determining factor in the location of ferro-alloy plants as well as in the choice of process employed for some alloys, according to a recent report made by Robert J. Anderson before the American Electrochemical Society in Boston. The domestic ferro-alloy industry has been centered for years near sources of relatively cheap power—Niagara Falls, chiefly, and the Pacific Coast—but with the advent of high prices during the war it was profitable to operate plants at points where power was relatively costly and far removed from the steel-making centers.

Foreign ferro-alloy progress has in the main followed the hydro-electric developments in France, Switzerland, Italy, Norway and Sweden, and the domestic ferro-alloy industry did not expand at the same rate as the foreign industry prior to the war because of the lack or remoteness of cheap power. This is a condition which will not be soon overcome in the United States, and ferro-alloy plants will continue to be located chiefly according to the relative weight of the following factors: (1) Cost and availability of power; (2) location of hydro-electric plant; (3) distance to steel-making centers; (4) location of high-grade ore supplies. The first three factors are the predominating ones under normal conditions, but emergencies such as a war can radically upset accepted practice.

Readers' Views and Comments

The Double-Base Lamp

To the Editor of the ELECTRICAL WORLD:

SIR: The double-base lamp described on page 1107 of your May 8 issue appears to have several inherent disadvantages which should be taken into account before it is too widely distributed. These disadvantages may be enumerated as follows:

First, the fact that one of the bases is "live" when the other is screwed into a live socket makes its use in the ordinary household dangerous. Receiving a shock from either carelessly or ignorantly touching the two contact points might prove fatal. Second, it appears from the illustrations that a much more complicated arrangement is necessary than with any of the double plugs or current taps on the market, involving the use of an extra socket and attachment plug. Third, it is necessary to have the light burning at all times that the lower end is in use, a condition which is neither desirable nor economical.

Bridgeport, Conn. JOHN W. SHALLENBERGER.

High-Voltage Transmission Systems

To the Editor of the ELECTRICAL WORLD:

SIR: I am greatly interested to note in your convention issue of May 8 the remarkable table, replete with valuable data, of the transmission systems in the United States, Canada and Mexico operating at 44,000 volts and over. In commenting on the splendid development that is thus evidenced, the remark may be made that it probably cannot be fully appreciated until one compares such conditions with those of little more than fifteen years ago. I have lying before me a list, now quite scarce. of polyphase plants, issued by the General Electric Company, under date of September 1903, enumerating plants that had been contracted for or installed up to that time where the total capacity was not less than 500 hp.

Of such plants there was the very respectable number of 332, on the North American Continent, in Japan, India, Africa, etc., but of all these only twelve were enrolled as operating at 40,000 volts or more. I cannot place my hand on any Westinghouse data of the same period, but perhaps we may assume about the same figure, or, say, a total of twenty-five plants at 40,000 volts and upward.

The new table in the ELECTRICAL WORLD brings to account no fewer than seventy-three plants of 44,000 volts or above, and in this compilation there is included no plant situated beyond the shores of the Atlantic or the Pacific.

Moreover, the General Electric table of 1903 gave only five systems with 60,000 volts line transmission. In the present table of seventy-three plants only ten are below 66,000 volts, but between 150,000 volts and 44,000 volts there is a literal riot of potentials, which becomes bolshevistic when you get to the transformers and substations. THOMAS COMMERFORD MARTIN.

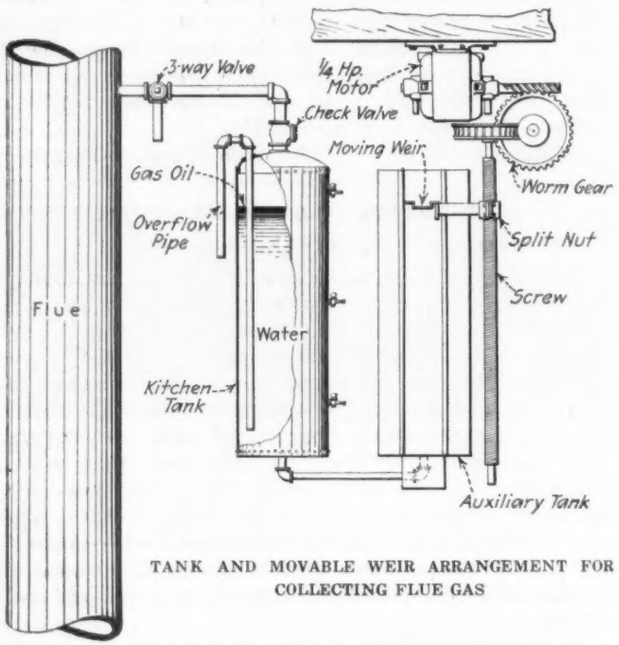
New York City.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

One Flue-Gas Test Tank Used for Three Shifts

BY THE aid of a traveling weir and suitable pipe connections analyses of average flue-gas conditions during each of three shifts are obtained from one 20-gal. (75.7-l.) kitchen boiler tank in an installation of thirty-two 500-hp. boilers at Joplin, Mo. The gas tank is connected to an auxiliary tank in which is a weir which travels from the level of the top of the tank to the bottom in twenty-four hours. The weir is moved by a vertical screw driven by a ¼-hp., 1,500-r.p.m.



TANK AND MOVABLE WEIR ARRANGEMENT FOR COLLECTING FLUE GAS

motor through two 50-to-1 worm gears which give a 2,500-to-1 speed reduction. After both tanks are filled with water the weir is made gradually to fall, reducing the water level in the tank 2.4 in. (60 mm.) per hour. This draws gas from the flue into the upper part of the tank. A split nut is provided for raising the weir after every day's operation. On the surface of the water in the tank is about 1 in. (25 mm.) of oil, and a check valve is provided to keep this from entering the gas inlet pipe. A water overflow pipe extends almost to the bottom of the tank and bends over at the top where a vertical pipe is tapped into the bend to act as a siphon breaker.

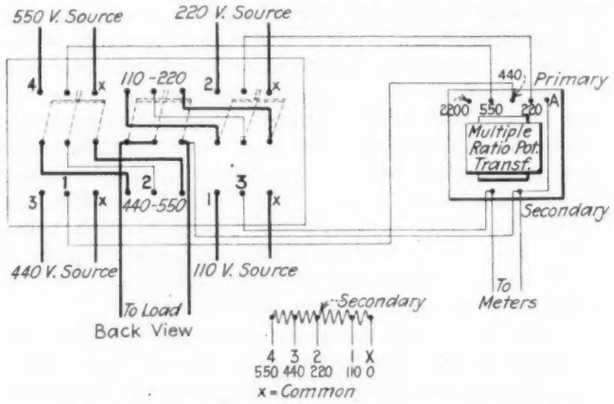
A three-way valve in the gas inlet pipe permits gas samples to be taken directly from the flues when desired. Cocks are inserted in the tank every third of the way from the top for taking flue-gas samples at the end of each shift. The second sample is the average of the first two shifts, and the third sample is the average for the day's run. The samples for the second and third shift are therefore corrected accordingly. Before taking any sample the top and side of the gas section of the tank are connected by a rubber hose and the gases are thoroughly mixed.

FRED M. RICHARDS,
Chief Engineer of Power Plants.
Empire District Electric Company,
Joplin, Mo.

Instrument Transformer Ratio Changed Automatically with Test Voltage

BY CHANGING the potential transformer connections automatically when the terminal voltage on the board is changed the switch arrangement here described prevents incorrect voltage from being impressed on the meters used. Four voltages, 110, 220, 440 and 550, may be obtained at the load terminals of this board by varying switches Nos. 1, 2 and 3 as shown in the table. When a certain voltage is impressed on the load terminals the same voltage is impressed on the multiple-ratio potential transformer and to protect the meters it is impressed on the primary terminals of this transformer corresponding to the voltage, so that about 110 volts is always impressed on the meters. In the diagram the meter connections are in light lines while the load conductors are shown heavy.

If the different sources are taken from taps on the secondary of the same transformer, so that one side, *X* (below), is common, the arrangement may be greatly



METER CANNOT BE SUBJECTED TO TOO HIGH VOLTAGE

For 110 volts, No. 2 up, No. 3 down, No. 1 out; for 220 volts, No. 2 up, No. 3 up, No. 1 out; for 440 volts, No. 2 down, No. 1 down, No. 3 out; for 550 volts, No. 2 down, No. 1 up, No. 3 out.

simplified by eliminating one blade on each of the switches, using two-pole switches instead of three-pole. This arrangement may also be used for direct-current work, the main lines being connected to the various voltage sources as with alternating current, but the instrument leads being connected to the respective taps on a multiplier instead of an instrument transformer.

Schenectady, N. Y. L. B. JOHNSON.

Tripod for Lowering Equipment Into Manhole

FOR lowering transformers and other heavy equipment into manholes the tripod shown here is employed by the Southern California Edison Company, Los Angeles. The tripod has three legs formed of pipe and fitted at the top with a cap holding an axle which pivots in the iron tripod head. By means of small

CHAINS PREVENT SPREADING OF TRIPOD LEGS

chains fastened from each leg to the next the legs are prevented from spreading. For lowering very heavy equipment a chain hoist is hung to an eye in the head of the tripod. Lighter equipment is handled by means of a cable passing over a pulley fastened on the top of the head.

C. W. GEIGER.

San Francisco, Cal.

How to Start Boiler Without Flooding Superheater

ALTHOUGH it formerly was the general opinion that superheater tubes should be filled with water while the boiler was being started up to prevent burning of the tubes, many superheaters are now operated without flooding. The old theory would probably still hold good if it were customary to put an extremely hot fire under a full boiler and force it to a point where it could be cut into line in a short space of time. The general practice today, however, of draining the tubes before starting a fire does not require flooding equipment, and this meets with the approval of the manufacturers. Before starting a fire in the Texas Power & Light Company under a boiler that has been idle or banked all superheater drainage valves are opened wide until the condensation has been completely drained. The drain valves are then turned to within one turn of the closed position and allowed to remain so until the boiler is actually in service. This will remove any accumulation of moisture due to condensation, will remove the air and vapor that is given off by the water in the boiler, and will create circulation in the superheater tubes and thus prevent overheating. If this procedure is followed, practically all danger of burning tubes is avoided.

Another most important factor in the operation of superheaters is the setting of the valves. These valves should be set to open before the safety valves of the boiler. This will insure circulation of steam through the tubes even though the station suddenly loses its load.

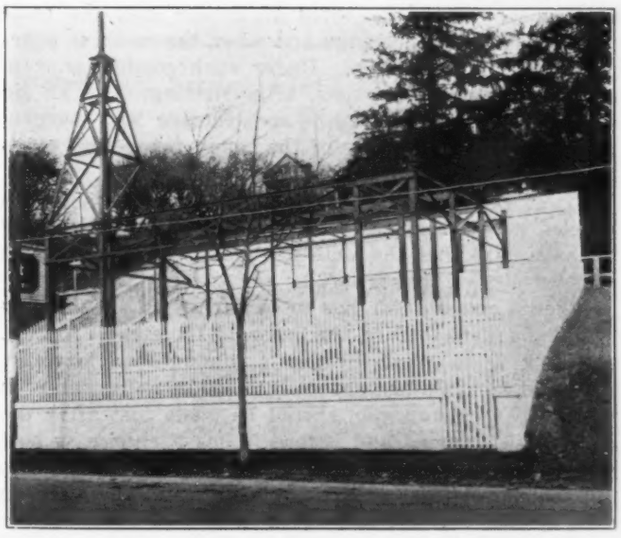
DANIEL G. FISHER.

Texas Power & Light Company,
Dallas, Tex.

Terraced Substation Built in Difficult Location

BECAUSE it was impossible to grade a strip of ground between two highways, the outdoor substation shown here was constructed with a terraced base on a side hill inclined about 40 deg. to the horizontal. Three air-cooled Pittsburgh transformers aggregating 2,000 kva. in rating, switches, meters and regulators were mounted on reinforced-concrete platforms located step-fashion on piers set into the bank. Uprights of 6-in. (15-cm.) H-section and 6-in. channels are used for the steel structure. The area occupied is 45 ft. x 26 ft. (14 m. x 8 m.), and a tower 42 ft. (13 m.) high is provided for the outgoing 2,300-volt lines. The overhead work, including two 2,300-volt buses and one 13,200-volt bus, is mounted on the steel structure. The structural cost of the installation exclusive of electrical equipment was $5,088.

This station, which is in Leicester, Mass., will be sup-



CONCRETE FOUNDATIONS ARE CONSTRUCTED IN FOUR TERRACES

plied from the Webster Street station of the Worcester Electric Light Company by a 13,200-volt, three-phase, lead-covered underground cable, and provision is being made for four outgoing 2,300-volt overhead circuits for local distribution, with an additional street-lighting circuit.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Commutator Slotting and Maintenance

COMMUTATOR slotting has been gaining favor in the industrial field, and today the majority of industrial and railway motor commutators are of the undercut type. Undercutting increases the life of both commutator and brushes and to a large extent eliminates flat spots, sparking, glowing of brushes and burning of the commutator. It also reduces the heating and in this way permits an increased load to be carried on the machines. Where undercutting has been found unsatisfactory it has nearly always been due to particles of mica being left flush with the commutator surface or to the use of improper brushes.

Commutator slotting, or, as it is often called, grooving, consists in removing the mica from between the commutator segments to a depth of about 1/32 in. to 1/16 in. (0.8 mm. to 1.2 mm.) below the surface of the commutator. The usual tendency is to undercut too deeply, and the rule should be to undercut little and often. The usual undercutting equipment consists of a circular-milling saw driven by some convenient means, although there are two or three hand tools on the market. These hand tools will ordinarily answer the purpose and in many cases give as satisfactory service as the automatic type of saw. Broken hack-saw blades are also frequently used for undercutting, but care must be exercised in the use of this tool.

The slots in the commutator should be cleaned out occasionally, especially when oil creeps onto the commutator from the bearings and when the machine operates in a dirty location. Under such conditions it is advisable to paint the slots, after slotting, with an air drying, insulating varnish and remove any surplus varnish from the surface of the commutator with sandpaper or a commutator stone.

After undercutting the mica each slot should be beveled with a V-shaped tool or commutator slotting file to make sure that the slots are free from mica and to remove burs of copper left by the slotting tool.

When a commutator has to be turned or ground this should be done before the mica is undercut. Before undertaking to grind or turn a commutator, however, it should be examined carefully to make sure that it is tight. The examination should be made just after the machine is stopped and before it has a chance to cool down, as the bars are most likely to be loose at that time. Most commutators need to be tightened after six to nine months' service and again after two years, owing to the seasoning of the insulation. However, they should remain tight indefinitely thereafter.

After the mica is undercut the commutator should be polished with a commutator stone or a very fine grade of sand paper attached to a block rounded to fit the commutator. Some engineers condemn the use of emery cloth for this purpose, but others find no difference between the effects of sandpaper and emery paper, provided that the emery paper is not too coarse. For all practical purposes, however, the commutator stone is safer to use as it leaves the commutator free from scratches. This is important as the brushes to be used on an undercut commutator have no abrasive action and therefore cannot polish out any scratches that are present.

DONALD S. MERTON.

Cleveland, Ohio.

Electrically Hardened Dies Have Longer Life Than Gas-Hardened Ones

COMPARISONS of taps hardened in an electric furnace and taps hardened in a gas furnace at the shops of the Frankford (Pa.) Arsenal indicate that superior physical qualities as shown by longer life are obtained with the electric treatment. The gas furnace was of the partial muffle type, burning illuminating gas. The electric furnace was, after brief instructions, operated by the same man who had been hardening taps in the gas furnace for several years.

The taps were 1.504 in. (38.2 mm.) in diameter, had twelve threads per inch (about 2.1 mm. thread), and were used in tapping fuse holes in 3-in. (75-mm.) steel projectiles. Tests were made on taps from four different brands of steel. The figures in the table represent the number of holes tapped after each grinding. With each brand of steel the taps hardened in the electrict furnace showed a greatly increased life over those hardened in the gas furnace.

NUMBER OF HOLES TAPPED BY DIES AFTER HARDENING

	New	First Re-grind	Second Re-grind	Third Re-grind	Total	Increase in Life per Cent
BRAND A						
Average (7) gas-treated	29	204	86	65	384	
Average (2) electrically treated.	100	270	33	103	506	32
BRAND B						
Average (7) gas-treated	84	151	25	36	296	
Average (2) electrically treated.	7	384	26	20	437	48
BRAND C						
Average (9) gas-treated	94	210	207	9	520	
Average (8) electrically treated.	414	232	129	8	782	50
BRAND D						
Average (7) gas-treated	131	243	340	71	792	
Average (2) electrically treated.	520	107	350	10	987	25

Except with brand B, the average is very marked before the first regrind. The fact that these taps averaged 384 holes after the first regrind indicates that the fault is not in the hardening but in some unavoidable feature in the grinding, or in the use of the taps. The outer case of the taps should be the hardest, and if the tap is held to shape in hardening, more of its hard surface remains for use. This would probably be the case in the electric furnace and might account for the greater life before the first regrind. Then, again, there is more decarbonization in the gas furnace, and

this would cause the surface to be composed of low carbon steel, which would not be good for cutting purposes. In the electric furnace the work is heated in a neutral atmosphere and emerges virtually as clean after hardening as before it was placed in the furnace, saving considerable time and money for finishing.

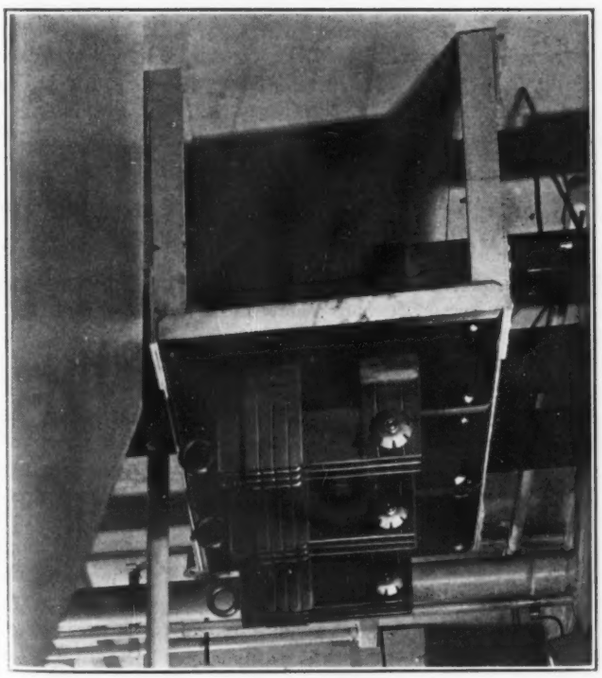
The electrical treatment given these dies, which is patented by the Leeds & Northrup Company, Philadelphia, makes use of a recording thermocouple which indicates by a "hump" in the temperature curve that the critical point in the heating of the metal has been reached. This hump corresponds to a pause in the temperature rise, in spite of the fact that heat is being steadily transferred to the work. It is said to be an accurate means for determining the exact amount of heating that should be applied to the material under treatment.

G. H. GIBSON.

New York, N. Y.

Mounting a 3,500-Amp. Switch in a Limited Space

ON ACCOUNT of the limited space available, a set of 3,500-amp. disconnecting knife switches shown here were mounted on the under side of three 8½-in. x ¼-in. (3.8-cm. x 0.7-cm.) angles. This structure was placed between the fire wall separating two rooms and the front of the switch cells in the switchboard room, each of the disconnecting switches having three ¼-in. x 3-in. (0.6-cm. x 7.5-cm.) blades. These switches are employed to cut off the 440-volt busbars from the service mains in one of the distributing switchboard rooms of



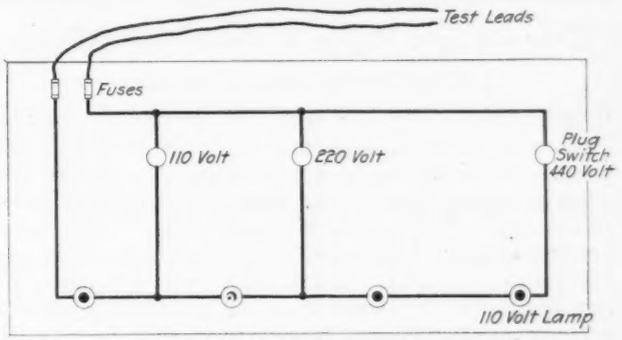
SWITCH MOUNTING SAVES ROOM AND REQUIRES LITTLE COPPER

the Gillette Safety Razor Company's factory at Boston, Mass.

In making repairs or other work necessitating the opening of a trunk line the switches, without load, can readily be opened from the floor level with the usual switch hook. When open they are high enough to be out of the way of any one passing beneath them.

Lamp Bank for Testing on Several Voltages

BY INSERTING the plug in the proper switch, the bank of test lamps shown in the accompanying illustration may be used on 110-volt, 220-volt or 440-volt circuits. To make this outfit, four sockets are mounted as shown and connected through two fuses to flexible test leads. Four 110-volt carbon incandescent lamps



PLUG INSERTED FOR DIFFERENT TEST VOLTAGES

are used in the sockets. This outfit is mounted in a box measuring 6 in. x 8 in. x 10 in. (12 cm. x 25 cm. x 20 cm.) with a heavy glass on each side, one glass being removable. A handle for carrying is placed on the top. The plug switches are mounted either on the outside of the box or inside so that the plug may be inserted through holes in the box. The plug for each respective voltage should be plainly marked.

As there are three voltages in the plant where this device was made, it was formerly necessary for the men to carry three outfits or else three extra bulbs. By means of the bank described much time has therefore been saved.

EUGENE TYLER,
Chief Electrician.

Massillon (Ohio) Bridge & Structural Company.

Reversed Series Field Caused Fan to Blow Fuses

EVEN though the series field on a compound-wound motor is reversed, if the motor is operating at a fairly light load it will perform its work without drawing an excessive current. When, however, the load is increased to full load, the series winding will greatly decrease the strength of the fields and thus the motor will draw a very heavy current. Such was the case in an Eastern macaroni-drying plant having a number of fans operated by compound-wound motors. These motors would run for days with perfect satisfaction, and then for an unexplained reason the fuses would begin blowing. An investigation finally showed that the motors generally operated about three-quarters load, but that when certain doors and windows were opened, allowing a draft to blow through the drying room in opposition to the direction of the fan draft, a heavier load was put on the motors. This heavier load by drawing more current through the series winding weakened the field, which in turn allowed still more current to flow. This resulted in blowing the fuses as has been described.

After the series field of these motors were reconnected correctly the motors operated satisfactorily under all conditions and have given no more trouble.

New York, N. Y. FRED SOLLER.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

How a Farm Paper Is Fostering Public Utility Service to Farmers

"A RATHER sinister agitation for 'home rule' by municipalities over the public utilities has developed in the Middle West," says the *Rosenbaum Review*, a farmers' publication having wide circulation in Illinois and other Middle Western states. This paper goes on to say: "Farmers and bankers are the people who should be most concerned, but they do not appear to realize it. Future development and prosperity of farming communities depend largely upon the amount and character of public utility service they can secure, because farming efficiency depends upon electrical power and interurban cars."

This paper also tells its farmer readers that "public utilities cannot be attracted to projects of expansion and intensive development if they have to serve many masters, as home rule implies.

Comparative Cooking Values of Coal, Gas, Various Fluid Fuels and Electricity

PROF. B. L. STEELE of the physics department of the Washington State College has prepared tables, the result of extended investigation made with great care, on the comparative efficiency of coal, gas, kerosene, gasoline alcohol and electricity as applied to cooking. The value in calories of 5 cents' worth of each of these fuels, excepting gas, at the prices prevailing in December, 1916, was:

Coal (Rock Springs), at $10 per ton	32,250,000
Kerosene, at 20 cents per gallon	8,550,000
Gasoline, at 25 cents per gallon	6,130,000
Alcohol, at 75 cents per gallon	1,340,000
Electricity, at 3.85 cents per kw.hr.	1,116,000

Professor Steele's second table gives the average efficiencies of the various kinds of cooking equipments. In determining the maximum efficiency of the coal range the entire top was covered with large vessels of water, the oven being similarly used. The fire was not lighted until the initial water temperature had been taken, and usually 2 lb. of kindling and 10 lb. of coal were completely burned before the record of the final maximum temperature was made. It was estimated that in the average home not more than one-fourth of the available coal-range space is utilized at any one time and that the cooking operations are carried on less than half of the time during which the coal is burning. The comparative figures in percentage of efficiency follow:

	Per Cent
Coal range (entire space utilized)	18
Coal range (estimated home cooking), about	2
Flame-contact burners (kerosene, etc.)	28
Electric heaters, surface	45 to 65
Electric heaters, inclosed	70
Electric heaters, immersion	90

Nearly every kind of electric heating appliance was used and under widely varying conditions. Room temperatures, existence of air currents from open windows, material and condition of surface of utensil used, wattage of heater, relative size of heater and utensil, and quantity of water heated, were all found to affect the efficiencies materially, particularly with heaters of the surface and immersion types.

Another table gives, in calories, the heat available for cooking in 5 cents' worth of each of the fuels, proper allowance having been made for the working efficiencies of the various cooking appliances:

	Calories
Coal (range at 2 per cent efficiency)	623,000
Kerosene (range at 28 per cent efficiency)	2,400,000
Gasoline (range at 28 per cent efficiency)	1,716,000
Electricity (range at 60 per cent efficiency)	669,600
Alcohol (at 28 per cent efficiency)	375,200

The average cost of cooking a meal with a coal range having the water front connected was found to be 5.70 cents, for a coal range with the water front disconnected 3.67 cents, and for an electric range 3.72 cents. These figures were quoted by M. C. Osborn of New Britain, Conn., in a paper presented under the auspices of the publicity committee of the New England Section, National Electric Light Association.

Revenue from Non-Ferrous Electric Furnaces More than from Induction Motors

SOME central-station men seem averse to supplying service to non-ferrous electric furnaces because they are usually single phase. However, R. F. Benzinger of the Electric Furnace Company, Alliance, Ohio, points out that two or three such furnaces can often be installed to balance the load, and even when that is not possible the single-phase resistance type of furnace will yield a greater income to the utility per kilowatt and per ampere of capacity provided than is obtained from the average three-phase induction-motor load.

The resistance furnace requires preheating for about three hours before the first charge, so that when working nine hours a day in a foundry the power consumption is uniform for about twelve hours. The load factor is then about 50 per cent, and as no inductance is required in the circuit the power factor is in the vicinity of 98 per cent. A single-phase, 100-kw. resistance furnace operated as above shows about 45 per cent more income per kilowatt of station and line capacity and about 25 per cent greater revenue per ampere capacity provided than a 100-kw. induction-motor load operating nine hours per day at an average of 60 per cent load factor and 80 per cent power factor. The increase in revenue will vary somewhat, depending upon the rates under which the service is supplied.

Promoting Acquaintance of Municipal and Utility Officials

TO ENABLE public utility men and representatives of city departments to get acquainted with one another, an organization known as the "Public Service Associates" was formed about six years ago at Springfield, Mass., upon the initiative of Walter L. Mulligan, general manager United Electric Light Company. At a recent meeting of the New England Section of the N. E. L. A. Mr. Mulligan, as chairman of the public policy committee, was asked to outline the work of this organization, which has been highly successful in maintaining a friendly co-operation among public service men.

"The idea," said Mr. Mulligan, "was to get the city and utility men to know each other, so that as matters came up regarding permits for underground work, poles, etc., time would be saved, and each side would know that the other was not quite so 'bad an actor' as might have been imagined beforehand. We meet once a month in Springfield around the luncheon table. The gas and electric companies are represented, the street railway, the telephone company, the three railroads entering Springfield, and head of the department of every subdivision of the city's activities, such as the sewer and street departments, engineering and public works, as well as the Mayor."

The speaker pointed out that all the individuals interested are present at a time when a given subject is under discussion. The press is allowed a representative. The plan has ironed out a great many troubles.

Electric Development of the West Compared with Other Sections

THE data in the report of the National Electric Light Association committee on water power which was presented at the Pasadena convention furnishes interesting comparisons of power production and consumption per capita. The Mountain and Pacific States of the Far West lead the nation in these respects—a fact of special interest in connection with the water-power legislation now pending in Congress, approximately 70 per cent of the undeveloped water power of the nation belonging to those states.

REVENUE, EXPENSES AND OUTPUT OF CALIFORNIA CENTRAL STATIONS *

	Total Gross Operating Revenue	Total Operating Expense
Standard Gas & Electric Company	$2,274,962.62	$1,638,046.33
San Joaquin Light & Power Company	3,211,570.44	2,215,982.47
Great Western Power Company	3,128,928.50	1,570,443.63
Pacific Gas & Electric Company	25,938,371.99	17,578,262.39
Coast Counties Gas & Electric Company	519,792.72	350,739.29
California Oregon Power Company	724,418.88	452,156.20
Southern California Edison Company	9,241,245.96	5,445,341.45
Mount Whitney Power & Electric Company	1,360,582.64	1,049,978.17
Southern Sierras Power Company	1,596,832.59	482,596.69
Western States Gas & Electric Company	1,901,330.61	1,105,292.74

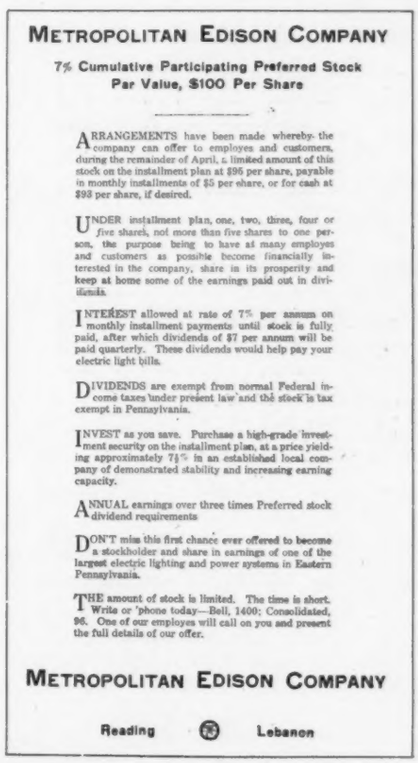
* Total output of all California companies, 3,334,430,841 kw.-hrs.

The data show that in the Western States the per capita consumption of power in 1919 was 673 kw.-hr., the Atlantic section coming next with a per capita consumption of 363 kw.-hr. The section having the smallest per capita consumption was New England, with 254 kw.-hr. The average of the whole country was 334 kw.-hr. The gross operating revenue for the California companies and their total operating expense are given in the accompanying table. On page 1099 of the ELECTRICAL WORLD for May 8, the output of all companies generating more than 100,000,000 kw.-hr. was given.

At the present time the Western load equals 1,289,000 kw., and careful estimates made by the individual companies indicate a peak in 1928 of 2,807,000 kw. The present load is being carried by an installed electrical capacity of 1,664,267 kw., which will have to be increased to 3,440,500 kw. in 1928. Of the former figure 1,241,312 kw. is now hydro-electric, and in 1928 2,753,000 kw. will be hydro-electric. This increase in plant will add $710,510,000 to the present investment of $665,706,800, making a total investment in 1928 of $1,376,216,800.

Pennsylvania Property Sells $558,600 Stock to Customers and Employees

DURING a four weeks' campaign which ended May 3 the Metropolitan Edison Company, Reading, Pa., through an organization composed exclusively of its employees, sold to employees and customers $558,600 of its 7 per cent cumulative participating preferred stock of a par value of $100 a share. Under a monthly saving investment plan the stock was offered in lots of one, two, three, four or five shares, not over five shares, at $95 per share, payable $5 a share at time of application and $5 a share each month thereafter until purchase price is paid. Those so desiring could buy the stock for cash at $93 per share and accrued dividend. Of the 5,586 shares sold, 2,764 were sold for cash and 2,822 were sold on the monthly saving investment plan.



METROPOLITAN EDISON COMPANY

7% Cumulative Participating Preferred Stock
Par Value, $100 Per Share

ARRANGEMENTS have been made whereby the company can offer to employes and customers, during the remainder of April, a limited amount of this stock on the installment plan at $95 per share, payable in monthly installments of $5 per share, or for cash at $93 per share, if desired.

UNDER installment plan, one, two, three, four or five shares, not more than five shares to one person, the purpose being to have as many employes and customers as possible become financially interested in the company, share in its prosperity and keep at home some of the earnings paid out in dividends.

INTEREST allowed at rate of 7% per annum on monthly installment payments until stock is fully paid, after which dividends of $7 per annum will be paid quarterly. These dividends would help pay your electric light bills.

DIVIDENDS are exempt from normal Federal income taxes under present law and the stock is tax exempt in Pennsylvania.

INVEST as you save. Purchase a high-grade investment security on the installment plan, at a price yielding approximately 7⅓% in an established local company of demonstrated stability and increasing earning capacity.

ANNUAL earnings over three times Preferred stock dividend requirements

DON'T miss this first chance ever offered to become a stockholder and share in earnings of one of the largest electric lighting and power systems in Eastern Pennsylvania.

THE amount of stock is limited. The time is short. Write or 'phone today—Bell, 1400; Consolidated, 96. One of our employes will call on you and present the full details of our offer.

METROPOLITAN EDISON COMPANY

Reading Lebanon

NEWSPAPER ADVERTISEMENT USED BY METROPOLITAN EDISON COMPANY

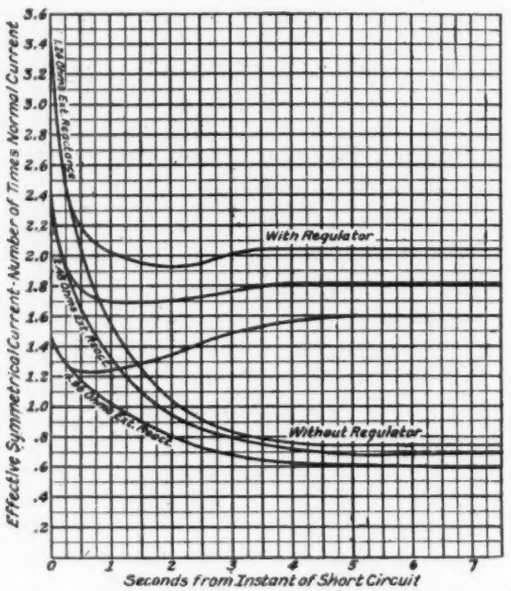
The above shares were sold to 2,353 purchasers, of whom 1,242 bought one share each, 523 bought two shares each and 308 bought five shares each. The balance comprises purchases of varying amounts. The purpose of this sale of stock was to provide capital for increasing the company's generating facilities and making other extensions to its property and at the same time give employees and customers an opportunity to participate in the prosperity of the company and become interested in its affairs.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Short-Circuit Tests on a 10,000-Kva. Turbine Alternator.—E. S. HENNINGSEN.—The series of tests described in this article were made for the purpose of amplifying data that had been compiled on the behavior of alternators under short circuit. The performance of definite-pole machines under short circuit had previously been analyzed, it is said, by means of extensive tests, but the characteristics of the alternator with smooth-


Effective Symmetrical Current-Number of Times Normal Current
Seconds from Instant of Short Circuit
With Regulator
Without Regulator

SHORT-CIRCUIT TEST OF A 10,000-VOLT, THREE-PHASE ALTERNATOR WITH EXTERNAL REACTANCE

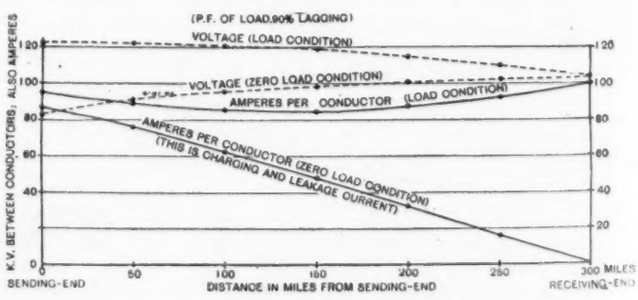
core rotor were not so well known. The tests were conducted under numerous conditions of short circuit, with various arrangements of reactors in circuit and with no reactors in circuit. Special precaution was taken to eliminate errors, and meter readings were taken as a check on oscillograph records. The curves show the effect of automatic regulator action on the value of armature current from the instant of short circuit until sustained values are reached.—*General Electric Review*, March, 1920.

Generation, Transmission and Distribution

Electric Drive in Paper Mills.—E. TANNER and C. F. PAPWORTH.—The writer gives a description of a large paper mill in the south of England having a capacity of 1,500 tons of paper per week. He deals particularly with the generating plants, lighting and heating, and the power installation. He states that approximately 250 motors are used, varying from 150 hp. to ¼ hp., embodying all makes of drive, direct-coupled, belt-driven, chain-driven or geared, according to the purpose for which they may be required. It has been found desirable in cases where motors of 40 hp. and over are controlled by the ordinary starting panel, comprising double-pole switch and fuses, ammeter and starter (such motors being variable-speed type are subject to momentary overload), to fit either a single-pole or double-pole circuit breaker in place of the usual fuses. This saves the expense and inconvenience of replacing the ordinary porcelain bases and fuse carriers. He states that the bulk of the service of the motors is driving pumps, which is of great importance in the paper mills. He foresees an excellent future for electricity in the paper mills in England.—London *Electrician*, March 26, 1920.

A National Power Distribution Project for Spain.—F. CHAPELAIN.—A final report has recently been presented by a Spanish commission which has investigated the advisability of providing Spain with a nation-wide system of high-tension transmission lines for utilization and distribution of the greater part of the available water power. It is estimated that while only 300,000 kw. are now developed, another 2,000,000 kw. could easily be added by further development of the waterfalls. In the report a distribution system is sketched which consists of a closed bus encircling the entire country, with interconnecting lines radiating from Madrid to various points on the circumference. The cost is estimated at 130,000,000 pesetas for a total of about 4,800 km. (3,000 miles) high-tension lines. The system is planned for three-phase transmission at 50 cycles and 120,000 volts. —*Revue Générale d'Electricité*, Feb. 21, 1920.

Electrical Characteristics of Transmission Circuits—VIII.—WILLIAM NESBIT.—One of a series of articles in which the performance of long transmission lines are considered. On account of the unusual distribution of current and voltage along the lines, a more rigorous solution is required in the particular case here considered than in those given in previous numbers of the series. The curves shown in the figure are for a 300-mile (480-km.) line operating at a nominal voltage of


(P.F. OF LOAD 90% LAGGING)
VOLTAGE (LOAD CONDITION)
VOLTAGE (ZERO LOAD CONDITION)
AMPERES PER CONDUCTOR (LOAD CONDITION)
AMPERES PER CONDUCTOR (ZERO LOAD CONDITION)
(THIS IS CHARGING AND LEAKAGE CURRENT)
K.V. BETWEEN CONDUCTORS; ALSO AMPERES
SENDING-END
DISTANCE IN MILES FROM SENDING-END
RECEIVING-END

CURRENT AND VOLTAGE DISTRIBUTION ON A LONG LINE

100,000 and at 60 cycles, and the curves show the variation current and voltage along the line. The electrical constants for such a line may be determined mathematically by the use of hyperbolic functions or by their equivalent convergent series. Graphically they may be

obtained to a high degree of accuracy from such diagrams as the Wilkinson charts, which are included in the article. The writer then shows the application of the Wilkinson chart to a typical long-line problem.—*Electric Journal,* March, 1920.

Over-Pressures in Hydraulic Conduits.—In some fundamental papers regarding the theory of hydraulic surges in closed conduits, such as result from manipulation of the outlet valve, Alliévi demonstrated a graphical method of finding the maximum pressure to be expected in practical cases. The present paper applies this method and shows in detail how to adapt it for the solution of various problems of this kind. A great number of graphical charts are presented, which materially simplify the discussion, and the method is said to have the advantage of not necessitating any thorough knowledge of the rather complicated mathematical theory of hydraulic surges.—*Revue Générale d'Electricité,* Jan. 17 and 24, 1920.

Possible Development of Hydro-Electric Power in British Guiana.—STAFFORD X. COMBER.—This is a preliminary report of the information gathered during a brief study of the Cuyuni, Lower Essequebo and Demerara Rivers. The relative advantages of various possible sources of power are discussed and definite recommendations are made with regard to the steps which should be taken in their development. The author considers the needs of hydro-electric energy for fertilizer and power for the sugar industry of British Guiana and recommends the continued study of the streams for early hydro-electric development.—*Report to Governor of British Guiana,* 1919.

Systems, Installations and Appliances

Electric Plowing Machines.—ACH. DELAMARRE.—At a fair in Saint Germain the Compagnie Electro-Mécanique for the first time demonstrated in public its electric plowing machinery. The plow is pulled by steel cables, which bend around drums on special anchored drum cars and run in on two large drums on the main electric power car, the car standing still during the plowing. The cable drums on the power car are actuated by a 500-volt, three-phase induction motor of 40 hp. output. The drum capacity is 600 m. (1,970 ft.) of cable, so that for each position of the power car four squares, each 240 m. x 240 m. (787 ft. x 787 ft.) may be plowed. A total area of 23 hectares (57 acres) thus may be covered without moving the power car. The disadvantage of this system, called the "roundabout" and originally developed by Howard for steam plowing, is that very heavy losses, amounting to 81.5 per cent of the total losses, are caused by the great length of cable which is always sliding along the ground when the plow is moving. The total cost of electric plowing with this outfit is estimated at 93.75 francs per hectare ($5.78 per acre) as compared to 153.20 francs per hectare ($9.55 per acre) for plowing by horse. One outfit is capable of covering 2.5 hectares (6.2 acres) per day, and the electric power consumption is about 90 kw.-hr. per hectare (36.4 kw.-hr. per acre).—*Revue Générale d'Electricité,* Jan. 10, 1920.

Electrophysics and Magnetism

On the Theory of Electron Discharge.—PAUL EPSTEIN.—The ordinary theory of the internal phenomena in electron discharge tubes extends analytical treatment only to the two limiting cases of (1) very high voltage, electron saturation, and (2) very large emission, space charge saturation. In general there will be formed around the filament a cloud of electrons, representing a negative space charge. The potential will therefore first fall to negative values and then gradually increase to positive values close to the anode plate. Thus, if an electron is emitted with enough velocity to pass through the retarding effect of the initial potential drop, it will reach the plate, but if its velocity is less than a certain critical value it will be forced back to the filament. Taking all this into consideration, and assuming that the electrons are emitted from the filament with a velocity distribution according to the Maxwell formula and that no collisions occur, the author has worked out a general solution of the Poisson equation, which degenerates in particular cases into the Richardson emission formula and into the Langmuir-Child equation involving the power of 3/2 of the anode potential. The theory refers to the idealized case of a plane-infinite system.—*Berichte der Deutschen Physikalischen Gesellschaft,* March 30, 1919.

Telegraphy, Telephony and Signals

New Phenomena Discovered by Means of Vacuum-Tube Amplifiers.—The tremendous energy amplifications obtainable in modern triode amplifiers seem to open up new fields for research concerning the constitution of matter. Recently Schottky stated that by employing sufficiently powerful amplifiers it should be possible to hear in a telephone the sounds caused by the individual electrons colliding with the atoms in a conductor carrying electric current. Schottky indeed suggested that a limit was set to the possible amplification obtained with electron tubes by the noises or electric disturbances emitted when the electrons impinge upon the plate of the tube. Barkhausen now has actually observed similar phenomena in ferromagnetic substances. In listening with a multistage amplifier across a coil wound on one leg of an iron core, he heard a crashing sound when the magnetic induction in the core was continually varied by advancing and then pulling back a magnet. He explains this sound as resulting from the electromagnetic shocks given to the amplifier when the individual molecular magnets suddenly go over from one polarity to the opposite as the field strength changes. The best results were obtained with rather thin wires.—*Physikalische Zeitschrift,* Sept. 1, 1919.

The Poulsen System of Radio-Telegraphy.—G. PESSION.—The subject is discussed under the five headings: General theory, technical production of the arc, matters relating to the production of the poulsen arc, efficiency of the arc, and arc and spark.—London *Electrician,* April 9, 1920.

Miscellaneous

Molded Insulating Composition.—R. T. FLEMING.—In this part of the article a description is given of the various raw materials that enter into the manufacture of molded insulating compositions. Some of the characteristics of the various types of molded compositions are given in above table.—*Beama,* March, 1920.

Material	Resists Temperatures of	Dielectric Strength	Moisture Absorption
Bakelite	100 to 200° C.	Medium 200 mil.	Very good
Molded rubber	To 100° C.	High 400/mil.	Good
Asbestos	Red heat	Low 100/mil.	Bad, 7%
Shellac	To 70° C.	Medium 250/300/mil.	Medium between(a) and (b)

SOMEWHAT better quantities of electrical supplies have reached jobbers this week. Special attention is being given to the clearing of sidings and yards, and a large number of freight cars have been unloaded and sent away. Manufacturers are able to lay hands on a few cars, and fresh shipments are beginning to come through.

IN THE non-electrical metal market price cutting has been assuming great proportions. Virtually no reductions are reported in the electrical markets except that certain large department stores are selling at low prices limited amounts of appliances bearing their own names as well as portable lamps.

JOBBERS in the vicinity of manufacturing plants have good stocks of materials from these factories. Those at a great distance are suffering from shortages. Regardless of other conditions, stocks are about dead on most steel materials used in the electrical trade.

BUYING of supplies is falling off because of inability to deliver. The demand, however, is as strong as ever and expected to increase.

OFFICERS of the National Electric Light Association for the coming year were elected at Pasadena as follows: President, Martin J. Insull, Chicago; first vice-president, M. R. Bump; second vice-president, F. W. Smith; third vice-president, Walter H. Johnson; fourth vice-president, F. T. Griffith; treasurer, H. C. Abell.

HOT SPRINGS, Ark., is likely to be the meeting place of the National Electric Light Association next year.

SECTION chairmen of the N. E. L. A. for the ensuing year are to be: Public Relations Section, J. E. Davidson; Technical Section, I. E. Moultrop; Commercial Section, M. S. Seelman; Accounting Section, J. C. Duyne.

FORTY-FOUR engineering organizations with an aggregate membership exceeding 100,000 have signified their intention to send delegates to the organizing conference of technical societies to be held in Washington on Thursday and Friday of next week. The American Association of Engineers will be represented.

FOR THE administrative year beginning August, 1920, A. W. Berresford of Milwaukee has been elected president of the American Institute of Electrical Engineers.

W. L. R. EMMET was made the tenth recipient of the Edison medal at the annual meeting of the A. I. E. E. last week.

GROSS earnings of the Westinghouse Electric & Manufacturing Company for the year ended March 31, 1920, were more than $136,000,000; net dividend available for income, $15,206,341.

MORE than $17,000,000 is to be spent this year on the projects of the Hydro-Electric Power Commission of the Province of Ontario.

PUBLIC utility delegates to the second annual convention of the Industrial Relations Association of America, held at Chicago last week, organized a public utility section of the association.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

ACTIVE co-operation by the government with public utilities in the study of the engineering involved in their business was urged by Dr. E. B. Rosa of the Bureau of Standards before the Washington Academy of Sciences.

FAVORABLE action on the formation of a Southwestern Geographic Section of the N. E. L. A. was taken at the Galveston meeting of the Southwestern Electrical and Gas Association.

TO MEET the cost of building a new steam-turbine plant the Hartford (Conn.) Electric Light Company is planning an increase in capital stock from $8,250,000 to $10,000,000.

IMPORTANT principles are at stake in the case of the Webster & Southbridge Gas & Electric Company, before the Massachusetts commission, against the entrance of the New England Power Company as a competitor for power business in a field hitherto cultivated by the former central station.

REVISED figures for "overhead" cost accepted by Massachusetts electrical contractor-dealers at Boston range from 46 per cent on jobs costing $200 to $500 to 10 per cent on jobs costing $50,000 to $70,000. Labor cost averages 40 per cent in these figures.

GOVERNOR COOLIDGE of Massachusetts in a special message to the State Legislature urged increasing the legal rate of interest on gas and electric utility bonds and notes above 6 per cent to attract capital.

R. SANFORD RILEY was elected president of the Stoker Manufacturers' Association at its Lakewood (N. J.) meeting.

A PROPOSED new code of ethics which it is suggested could serve as a basis of a declaration of principles for all engineers was prepared by a committee of the American Society of Mechanical Engineers for discussion at its St. Louis convention.

VALUATION of public utility properties at present construction costs is favored by Sanford Robinson of New York, who recently testified before the Interstate Commerce Commission.

TEXAS may establish a public utilities commission at a special session of the Legislature now being held. Such a body, subordinate to the principle of municipal home rule, is favored by the League of Texas Municipalities.

PROPOSED changes in the National Electrical Safety Code affecting pole strength, joint poles, signal lines and other requirements have been issued by the Bureau of Standards.

IN THE majority report of the special war expenditures committee to Congress the government war loan to the Alabama Power Company is condemned as unjustifiable and unnecessary and the government's policy is held to have built up a monopoly of power in northwestern Alabama.

THE REPORT of the American representatives at the meeting of the technical committees of the International Electrotechnical Commission indicates progress toward adoption of international standards.

GOVERNOR SMITH of New York vetoed the daylight-saving repeal bill passed by the Legislature.

TO SAFEGUARD the Greater Wheeling (W. Va.) district in emergencies, the Wheeling Electric Company is to build a new power loop to Windsor.

SHORTAGE of coal caused by the freight blockade again threatens public utilities in the East and the Middle West.

TEMPORARY growth in the number of casualties in public utility operation is ascribed by the Utilities Mutual Insurance Company to "military scorn for personal danger" on the part of returned soldiers.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Utilities Again Feeling Pinch of Coal Shortage

DIMINISHING coal piles because of the transportation tie-up are becoming rather alarming in the electric light and power field. The most pessimistic reports come from the Middle West, although one of the large Eastern systems at one time was down to a single day's supply.

The Indiana Public Service Commission has recommended that the Interstate Commerce Commission establish priority shipments of coal for public utilities.

The Michigan Public Utilities Commission has made a similar request. An acute coal shortage exists in Michigan, where 125 electric light and power plants are said to be extremely short. In fact, plants in Kalamazoo, Saginaw, Pontiac and some others in smaller places, according to reports, have been obliged to shut down completely.

New York's coal supply seems to be in fair condition, but the same is not true of Chicago. The Commonwealth Edison Company, it is reported, has recovered only half of the 1,500 coal cars loaned to the government almost a year ago.

The situation, however, is expected to become easier as authority has been invested in the Interstate Commerce Commission to move coal by securing "empties" for the West.

New Power Loop to Protect Wheeling Against Storms, Strikes, Etc.

TO SAFEGUARD the Greater Wheeling (W. Va.) district in the event of emergencies, such as storms, strikes or other situations that cannot be controlled, the Wheeling Electric Company will establish a new power loop to Windsor on the West Virginia side. Work will be started in the course of the next three weeks.

Although it is not generally known, the city of Wheeling is at the present time being supplied with light, heat and power from Windsor by way of the two loops on the Ohio side. Since May 1 the electrical workers of the Wheeling company have been on strike and the Wheeling plant has been closed down.

The new loop will run through Fulton at Rudler's, where a substation will be erected, and continue on a straight line due north to Windsor. The work on the substation will start in three weeks' time, but on account of the difficulty in procuring steel, the loop will not be begun till Aug. 1. The new loop will increase the capacity of the plant, according to Superintendent J. B. Garden, and give three methods by which to get power down to Wheeling.

The frequent damage wrought by winter and summer storms, as well as other contingencies, has made the move imperative for the protection of patrons in this district. The substation at Rudler's will supply the suburban district with light and also be used to distribute light and power to the Mold & Foundry and Whitaker-Glessner plants.

W. L. Emmet Receives Edison Medal at Annual Meeting of A. I. E. E.

WILLIAM LEROY EMMET was formally presented with the Edison medal, for inventions and developments of electrical apparatus and prime movers, at the annual meeting of the American Institute of Electrical Engineers on Friday evening, May 21. The medal is awarded, it was explained by Dr. Carl Hering, by the Edison medal committee "for meritorious achievements in electrical science, electrical engineering or the electrical arts." Associates of Thomas A. Edison founded the medal in 1904 to commemorate the period in the rise of electrical engineering of which Edison is typical. Mr. Emmet is the tenth recipient of the Edison medal, which has been awarded yearly, with the exception of the year 1915, since 1909.

In discussing Mr. Emmet's achievements, H. W. Buck, past-president of the Institute, pointed out that by tradition and inheritance Mr. Emmet should have been an artist, but that the artist's vision to see great things and the power to bring them into reality were valuable attributes to his success as an engineer. In looking back over the work which Mr. Emmet has carried on for twenty-five or thirty years its originality is sometimes in danger of being overlooked. However, Mr. Buck reminded the meeting, much of the present-day construction and design of electrical apparatus which is now accepted as standard practice is the direct result of methods conceived and applied by Mr. Emmet in the early period of the industry when everything was on an experimental basis. He was chiefly responsible for present insulation methods when in 1887 he substituted oiled cambric for shellacked mica insulation. The oil-immersed switch was distinctly an idea of Mr. Emmet's and came at a time when the development of the central stations had come to a standstill because of their inability to control the circuits.

Mr. Emmet started his most important work, Mr. Buck stated, in 1900 in the development of the Curtis steam turbine. Here again his vision of the possibilities of the turbine enabled him to carry his operations through to success, and in 1902 the first 500-kw. machine was installed at Newport, R. I., and was very successful. This was followed about three months later by a four-stage 3,000-kw. machine which gave much better steam economy and really established the turbine on a firm basis. By the end of that year the first and famous 5,000-kw. machine was installed in Chicago, and its success soon became known all over the world.

In connection with Mr. Emmet's work on the turbine he was the first to point out to steam engineers the tremendous importance of high vacuum in the operation

of the turbine. Development of the turbine for ship propulsion was started by Mr. Emmet in 1907 and was first introduced on two fire boats in Chicago. In 1909 the first proposition was made to the government for the operation of battleships in this manner.

In his response following the presentation of the medal Mr. Emmet told in an interesting and sometimes amusing manner about his early experiences with the first street railway motors, the obstacles overcome and the inadequacy of equipment with which he had to work. Of his work in the development of alternating-current generators he stated that one of the greatest difficulties that had to be surmounted was the hunting of alternators operated in parallel by reciprocating engines. This apparent defect of the electrical apparatus he traced to the engine governors, and with a few changes in design which he suggested the trouble was entirely eliminated. The first successful parallel operation of alternating-current generators was in Omaha, where forty-eight-pole, 300-kw. machines were installed. Speaking of his work on the turbine, he paid tribute to the support and assistance which Mr. Curtis gave in its development.

COMMENT ON MERCURY TURBINE

At present Mr. Emmet is working on the perfection of a mercury turbine from which highly efficient results have been obtained. Preferring not to go into details on this subject, he said that the over-all thermal efficiency of the mercury turbine equaled that of the Diesel engine and were the firing conditions up to the standard of a large central-station boiler room energy could be generated on the basis of 11,300 B.t.u. of fuel consumed per kilowatt-hour.

To show the extent of Mr. Emmet's activity in the electrical art, it may be added that he has taken out 105 patents on electrical and kindred apparatus.

As this was the annual meeting of the Institute, the report of the board of directors was made and the result of the ballot on the amendment to the constitution and election of officers was announced. The vote on the amendment to the constitution showed 3,936 in favor of and 36 against the adoption of the amendment, which permits the creation of districts, each district to be presided over by a vice-president.

A. I. E. E. OFFICERS

The following officers were declared elected for the administrative year beginning August, 1920: President, A. W. Berresford, Milwaukee; vice-presidents, E. H. Martindale of Cleveland, Charles Robbins of Pittsburgh, Charles S. Ruffner of New York, C. E. Magnusson of Seattle, C. S. McDowell, U. S. and L. T. Robinson of Schenectady; managers, E. B. Craft of New York, Harold B. Smith of Worcester and James F. Lincoln of Cleveland; treasurer, George A. Hamilton, Elizabeth, N. J. (re-elected).

The above, together with the following hold-over officers, will constitute the board of directors for the next administrative year: Calvert Townley, New York; Comfort A. Adams, New York; Walter A. Hall, Atlantic, Mass.; William A. Del Mar, New York; Wilfred Sykes, Pittsburgh; Walter I. Slichter, New York; G. Faccioli, Pittsburgh; Frank D. Newbury, Pittsburgh; L. E. Imlay, Niagara Falls; F. F. Fowle, Chicago; L. F. Morehouse, New York.

At the meeting of the board of directors held on the same date F. L. Hutchinson was re-elected secretary.

Electric Utility Securities Compare with Industrials in Permanence of Value

IN AN interim report to the Investment Bankers' Association of America by the committee on public service securities, of which O. B. Willcox of Bonbright & Company is chairman, the inevitable expansion of the electric power industry is predicted. A review is made of the effects of war-forced economy on the public utilities, the cost of generating energy, the increased use of electricity, electrification of the railroads, and the present financial status of electric central stations.

Recent reports of electric power companies, the report states, indicate that under commission regulation these companies have largely offset increased costs of operation by increase of rates for service, with resulting recovery in net earnings, and the rate of earnings of many of the power companies shows satisfactory surplus above charges. Their reports further indicate, it is pointed out, that power companies are again getting into position to justify the confidence of the investment banker in financing their maturities and their requirements for new capital for expansion and sustaining their contentions that electric power and light companies offer investment securities comparable with the best industrials in permanence of real value and certainty of return.

"As the pressure of the high costs of operation, with resulting decrease in earnings, disturbed confidence in public utility securities," the report concludes, "so the response made by regulating authorities in approving rate increases should tend to restore that confidence, strengthened by proof accumulated through the war period that the public and the regulating commissions recognize that the power and light companies are an essential part of our industrial fabric and are entitled to fair rates for their service and a fair return.

"With improving earnings and with full appreciation of the economic and financial history of these companies during and since the war period, their credit should steadily improve and their requirements for money with which to meet maturing obligations and to expand their facilities to take on business offered should again be satisfied through investment markets (subject, of course, to general financial conditions) at gradually decreasing costs for money; and it may also be expected that the general price level of the outstanding securities of companies which have creditably survived the disorders of the past few years will substantially improve."

Aylesworth to Address Canadian Electrical Association

JUNE 16, 17 and 18 have been selected as the dates for the annual convention of the Canadian Electrical Association, which will be held at the Ritz-Carlton Hotel, Montreal. The first day will be devoted to reports of committees and of representatives on the committees of the National Electric Light Association. On the second day M. H. Aylesworth, executive manager of the N. E. L. A., will speak on the enlarged activities of that body and the work accomplished at the Pasadena convention. There will also be a paper by Paul M. Lincoln on the maximum-demand meter and other papers not yet announced. An executive session will occupy the last day of the convention, and the revised constitution will be placed before the delegates for their approval.

More Than 100,000 Engineers to Be Represented at Conference

UP TO May 25 forty-four engineering organizations, with an aggregate membership exceeding 100,000, had signified their intention to send delegates to the organizing conference of technical societies in Washington, D. C., Thursday and Friday, next week. Details of the tentative program were announced in ELECTRICAL WORLD last week. There will, in all probability, be certain minor changes before the date of the meeting, but the sessions will follow the general plan previously outlined. Here follows the complete list of societies which will be represented at the conference:

American Association of Engineers, American Association of Petroleum Geologists, American Ceramic Society, American Electric Railway Engineering Association, American Electrochemical Society, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, American Railway Engineering Association, American Society for Testing Materials, American Society of Civil Engineers, American Society of Mechanical Engineers, American Society of Refrigerating Engineers, American Society of Heating and Ventilating Engineers, American Society of Safety Engineers, American Water Works Association, Illuminating Engineering Society, Institute of Radio Engineers, Mining and Metallurgical Society of America, Society for the Promotion of Engineering Education, Society of Automotive Engineers, Society of Naval Architects and Marine Engineers, Society of Industrial Engineers, Colorado Society of Engineers, Portland Technical Council, Kansas Engineering Society, Engineers' Society of Western Pennsylvania, Mohawk Valley Engineers' Society, Florida Engineering Society, Illinois Society of Engineers, Indiana Engineering Society, Brooklyn Engineers' Club, Cleveland Engineering Society, Detroit Engineering Society, Vermont Society of Engineers, Society of Engineers of Eastern New York, Associated Engineering Societies of St. Louis, Atlanta Joint Technical Society, Engineers' Club of Trenton, Engineering Society of Buffalo, Engineers' Club of Columbus, Engineers' Club of Philadelphia, Washington Society of Engineers, Joint Council of Engineers, St. Louis; American Concrete Institute, New England Water-Works Association, Engineering Society of Akron and National Fire Protection Association.

Southwestern Association Holds Most Successful Convention

IN ATTENDANCE, interest manifested, work done and results accomplished the fifteenth annual convention of the Southwestern Electrical and Gas Association, held at Galveston, Tex., May 13, 14 and 15, stands out as the most successful in the history of the association.

The most important features of the convention sessions, in addition to the question box, were the address by G. L. Burr of the Guaranty Trust Company of New York on "The Successful Financing of Public Utility Needs" (reported in the ELECTRICAL WORLD for May 15, page 1154); an address by B. J. Mullaney of the Illinois Committee on Public Utility Information on the work of that committee and its results; an address by W. H. Blood, Jr., on "Insurance and Kindred Matters Affecting the Public Utility Industry"; an address by J. F. Owens of the Oklahoma Gas & Electric Company on "Public Utility Association Work"; an address by Dr. E. P. Schoch, head of the department of chemistry of the University of Texas, on "The Unlimited Possibilities of the Unlimited Supply of Texas Lignite," and an address by H. C. Abell, treasurer of the National Electric Light Association, explaining the work and possibilities of the national association as an aid and asset in state or sectional association work and urging the formation of a Southwestern Geographic Section of the N. E. L. A. by the associations of Texas-Louisiana, Oklahoma and Arkansas. Favorable action was taken. The convention was also addressed by representatives of the Mississippi Electrical Association relative to its admission into the Southwestern Geographic Section. Action will be taken on the matter at an early date by the Texas, Oklahoma and Arkansas Associations.

A committee of eleven operating and technical members was appointed to investigate the matter of Texas lignite and report to the executive committee.

Entertainment features included a ball at the Hotel Galvez given by the supply section, a banquet-"joviation" given by the association and other special entertainment for the visiting bodies.

A. Hardgrave of Dallas was elected president, C. E. Calder of Dallas first vice-president, Alba H. Warren of El Paso second vice-president, S. R. Bertron, Jr., of Houston third vice-president, H. S. Cooper of Dallas secretary, and J. B. Walker of Dallas treasurer.

A. A. E. States Position on Proposed National Federation

THE American Association of Engineers has accepted the invitation of the joint conference committee of the national technical societies to the conference to be held in Washington on June 3 and 4 for the purpose of forming a comprehensive organization. In its letter of acceptance the A. A. E. indorsed the provision for non-interference with interrelations with respect to technical matters and the maintenance of the autonomy, functions and operations of individual organizations. The idea of having local affiliation of existing groups of engineers in order to facilitate united action in local questions of public welfare and other matters of common interest was approved.

The proposition for a national association of engineering organizations by means of a national council composed of representatives widely chosen by local affiliations or organizations and by national organizations, meeting annually and acting through an executive board, did not meet with the favor of the A. A. E., which held that such a plan would duplicate effort and add useless machinery, tending to restrict progress along welfare and non-technical lines.

"Our association," the letter states, "is doing such work at the present time in an efficient manner, and our growth proves that results are being obtained. This viewpoint is based on the result of our experience, and consequently we do not believe that the organization proposed would be any inprovement over existing machinery." For this reason it was stated that little or no financial help could be expected from the A. A. E.

The A. A. E. also stated that in its opinion the simpler the machinery of organization the better will it be adapted to expansion.

The following delegates have been selected to represent the A. A. E. at the conference: George W. Fuller, consulting engineer, New York City; Isham Randolph, consulting engineer, Chicago; W. H. Finley, president, Chicago & Northwestern Railroad, Chicago; Dr. F. H. Newell, head of the department of civil engineering, University of Illinois; L. K. Sherman, president of the United States Housing Corporation, Washington, and president of the A. A. E.; Daniel L. Turner, chief

engineer Transit Construction Commission, New York City; A. B. McDaniel, principal engineer construction division of the army, Washington; R. C. Bailey, district secretary of A. A. E., Washington; William J. H. Strong, president Chicago Chapter, A. A. E.; A. N. Johnson, consulting highway engineer, Chicago; Dean G. M. Butler, University of Arizona; H. O. Carman, chief engineer Public Service Commission of Indiana; I. W. McConnell, New York City; Morris Bien, assistant to the director United States Reclamation Service, Washington; W. A. E. Doying, inspecting engineer Panama Canal, Washington; J. K. Anderson, consulting engineer, Charleston, W. Va.

Proposed Code Changes on Signal Lines, Pole Strength and Joint Poles

PROPOSED changes in the rules on signal lines, on required pole strength, on joint poles and other subjects of Part 2 of the National Electrical Safety Code were issued May 15 by the Bureau of Standards. Signal lines are now subjected by these changes to most of the requirements imposed upon supply lines, although there are some differences which will be enumerated below; where a weak pole is supported by two adjacent poles the average strength of all three must meet the code requirements.

In the changes for signal lines the rules have been made the same as those for supply lines regarding location of poles, guys and anchors, regarding insulators or guards for guys and spans, and regarding strength of poles and cross-arms. Among the exceptions is the rule that signal conductors may be spaced 3 in. apart where this has been customary and may be strung on the same arm with 7,500-volt lines owned by the same utility. For spans up to 150 ft. signal conductors which would fall in class C may be graded D. The minimum allowable conductor sizes are also smaller than for supply lines as outlined in the November changes of the code, and further changes allow No. 10 steel to be used on spans of 125 ft. to 150 ft. at crossings in arid regions. The sizes for aluminum wire have been eliminated, but all conductors must have the strength of the minimum hard-drawn copper conductor. Clearance of signal wires over spaces accessible to pedestrians only shall be 12 ft. for circuits over 150 volts. The clear space at the crossing of the lowest signal wire, guy or messenger and the lowest wire of a similar nature paralleling a railway track shall be at least 2 ft. where the sum of the distances from the nearer support of each span is not more than 100 ft. The working tension of messenger cable is set at 3,500, 5,900 and 9,500 lb. for cable weighing respectively under 2.5 lb., from 2.5 lb. to 5 lb. and from 5 lb. to 8 lb. per foot.

The principal ruling regarding pole strength is that a pole not meeting the requirements will be permitted when it is the center pole of three, of which the average strength meets the requirements, provided that the weak pole is not less than 25 per cent of regulation strength. The specifications for strength apply to grade B construction. Grade A is one and a half times grade B, while grade C is two-thirds of grade B. Another revision is that for "special" poles (except at crossings over railroads or signal lines) two-thirds of the moment due to wind pressure shall be used in finding the stresses on the poles. These "special" poles must be especially selected clear wood, must correspond to poles usually classified as class A for grade A or B, and as class B for grade C, and they shall be systematically inspected and maintained.

Where at a crossing, or in cases of conflict or common use of poles, circuits of different grades are concerned the construction for the upper circuit must be at least as good as would be required for the lower circuit if it were above. For joint poles constant-current circuits of 10 amp. require class A and circuits of 7.5 amp to 10 amp. require class B construction. Span wires or brackets on lamp or trolley wires on joint poles must be at least 2 ft. from signal-line cross-arms, 1 ft. from signal-line messengers, and preferably 1 ft. from signal terminal boxes. Where a signal line is below the supply line and carries not over four wires, mainly for local service or subscribers' loops, or not over two local telegraph or fire-alarm wires, grade C may be used for the supply line. Clearance between conflicting lines shall be at least 4 ft. and not under the normal sag of the conductor with greater sag, plus 0.2 in. per kilovolt of the higher voltage.

The minimum allowable conductor for medium and light loading is now No. 6 medium or hard-drawn copper, and for steel No. 8 for less than 150 ft. and No. 6 for longer spans. Factory flash-over tests on pin-type insulators are now required to last only three minutes.

Westinghouse Company's Gross Earnings $136,052,092

ALTHOUGH the gross earnings of the Westinghouse Electric & Manufacturing Company, as shown by its annual report for the year ended March 31, 1920, were $24,327,851 less than the 1919 figures, the net manufacturing profit of $15,079,830 is only $632,711 below the 1919 level. The gross business of the year was $136,052,092, or the second largest ever reported by the company. In 1919 the company reported a gross of $160,379,943. Interest charges and taxes were substantially reduced during 1920, and the net income available for dividends in the year just closed was $15,206,341, as compared with $15,059,008 for 1919. The balance sheet shows current assets of $101,896,951 and current liabilities of $31,002,540. Working capital of $70,894,411 is shown, and the surplus at the end of March was $43,435,763. In 1919 the working capital of the company was $69,694,611. Inventories in the present report are placed at $63,018,123 as compared with $59,550,262 in the preceding year.

In his statement to stockholders Guy E. Tripp, chairman of the board, said in part:

Throughout the year, but more particularly during the last six months, there was a gradually increasing demand for the products of your company. The value of unfilled orders on April 1, 1920, was $71,156,732. The property and plant account representing real estate, buildings, equipment, etc., shows a reduction as compared with the previous year, due in part to the sale of certain plants which were engaged mainly in the manufacture of munitions. During the year H. W. McCandless & Company was dissolved and its business taken over by the Westinghouse Lamp Company. The stock of the J. Stevens Arms Company has been sold; therefore its operations are not included in this report.

The development and extension of the business of your company, together with the increased costs of operation due to higher wages and higher prices for raw materials, have required a large amount of additional capital.
is in excess of its present plant capacity and a continuation of this demand will make necessary further additional facilities and still larger working capital.

The current demand for the products of your company

More Than $17,000,000 to Be Spent on Ontario Hydro-Electric Schemes

ACCORDING to a published statement, more than $17,000,000 is to be spent on the Hydro-Electric schemes of the Province of Ontario this year. A great proportion of this, $10,500,000, is for the Queenston-Chippawa development. The next largest sum is for the Port Arthur and Thunder Bay development, $2,500,000. Following are the estimates of expenditure: Niagara system, $1,250,000; Severn system, $50,000; Eugenia and Saugeen systems, $475,000; Muskoka system, $40,000; Port Arthur and Thunder Bay or Superior system, $2,500,000; Wasdell system, $90,000; St. Lawrence system, $500,000; Rideau system, $250,000; miscellaneous, $500,000; Queenston-Chippawa development, $10,500,000; Central Ontario system, $750,000; Nipissing system, $175,000; expenditures on account of province, $177,000.

Public Utility Employment Managers Organize

WITH the object of developing the employment and personnel work in which they are most directly interested, the public utility delegates to the second annual convention of the Industrial Relations Association of America, held in Chicago, May 19-21, 1920, organized a public utility section. W. H. Vickers, employment manager of the Consolidated Gas, Electric Light & Power Company of Baltimore, was chosen chairman, and F. F. Hennaman, personnel supervisor of Day & Zimmerman, Inc., Philadelphia, secretary and treasurer. A meeting will be called at a time and place to be decided later at which definite plans for work will be formulated.

J. E. Shute, assistant to the general superintendent of the Penn Central Light & Power Company, Altoona, Pa., described a system of rating employees which has reduced their labor turnover from 122 per cent for the year prior to the operation of the system to 24.3 per cent for the first ten months of its operation.

Stoker Manufacturers to Continue Work Begun During War

ORGANIZED as an aid to fuel conservation during the war and to protect the interests of this important group of manufacturers, the Stoker Manufacturers' Association has just as great work to do in the future, declared President P. A. Poppenhusen in his opening address to the Association at Lakewood, N. J., on May 18, to promote a co-operative spirit, maintain high ethical standards of business dealing and make the customer realize that buying a stoker is more than buying so much cast iron, being rather the buying of engineering knowledge.

S. A. Armstrong, in a paper on the "Development of Stoker Organization from the Standpoint of Ideals and Ethics," emphasized the need for ethical dealings.

That, important as the relation of the cubic feet of combustion space to the square feet of grate surface is as regards the efficiency of combustion, this particular point has not been given the serious consideration that it deserves was the opinion voiced by Henry Kreisinger, Bureau of Mines, in his talk on the relation between the combustion space and the efficiency of combustion. He showed numerous tables and curves of actual tests made by the Bureau of Mines.

A. R. Maujer talked to the association on the possibilities of co-operative advertising.

Of the fifteen member companies of this association eleven had representatives at the meeting, with an attendance of about twenty-eight representatives. Officers elected for the ensuing year were as follows: President, R. Sanford Riley, Sanford Riley Stoker Company; vice-president, M. Alpern, American Engineering Company; treasurer, H. E. Pratt, Babcock & Wilcox Boiler Company; secretary, J. G. Worker. The two other members of the executive committee were H. A. Hatton, Laclede Christy Clay Products Company of St. Louis, Mo., and S. A. Armstrong, Underfeed Stoker Company of America, Detroit, Mich.

Utility Interest Should Exceed 6 Per Cent, Says Massachusetts Governor

IN A SPECIAL message to the Massachusetts Legislature on May 19 Governor Coolidge declared that the legal rate of interest on public utility securities should be increased above 6 per cent, in view of the present high cost of money and inability of such companies to issue securities at rates which will attract new capital. The ways and means committee will report a bill to this end. The message follows:

> Several of the gas and electric light companies of the commonwealth find it necessary to finance themselves to provide for meeting maturities on notes and bonds. They are unable to sell stock and are unable to sell bonds on this market without paying above the present legal rate of 6 per cent.
>
> There are two courses open—to increase the charge made to the public for gas and electric light service to such an extent as to insure returns considerably in excess of what has heretofore been the policy of this commonwealth, or to provide temporarily for financing at an interest charge in excess of 6 per cent. It seems perfectly apparent that the public welfare would best be served by the latter course. It is therefore recommended that the rate of interest at which such companies can issue bonds and notes which may be issued within a period not in excess of five years from the taking effect of this recommendation as law be such as is approved from time to time by the Department of Public Utilities. If this be done, it will no doubt result in a considerable saving to the public.

Entertainment Details of Contractors' Convention in October

ARRANGEMENTS have been partially completed for the coming convention of the National Association of Electrical Contractors and Dealers to be held in Baltimore during the week of Oct. 4. Headquarters will be at the Southern Hotel, where all meetings will be held The executive committee meets Oct. 4 and 5. The convention proper opens the morning of Oct. 6, and in the evening there will be a reception and dance. The afternoon of Oct. 7 will be devoted to an outing to Annapolis, Md., where the delegates will be addressed at the State House by Governor Ricky, going afterward to the Naval Academy. The annual dinner of the association will be held Oct. 8.

Secretary W. H. Morton announces that the "Standard Cost Accounting System" put out by the association has been advanced in price in order to cover the greatly increased cost of paper, handling charges, etc. The association is still handling the system to members at cost. The new price of the complete system is $35 to members and $50 to non-members.

Texas Considers Placing Utilities Under State Regulation

WHETHER or not the Texas State Legislature at a special session now being held will be called upon to enact a law placing public utility plants under state control will, it is stated, depend upon the length of the session and the time that may be at the disposal of the lawmaking body to consider such legislation. At the recent annual convention of the League of Texas Municipalities a resolution was adopted placing that body on record as favoring the creating of a public utilities commission. The resolution, however, has a distinct flavor of home rule. It declares that "every municipality, whatever its size, should have the right to regulate the service rendered and the rates charged within its corporate limits by public utilities."

The resolution further asserts that utilities which serve municipalities or communities indirectly, by supplying any commodity or service to local utilities which in turn distribute it to the public, should be completely under the control and regulation of the Public Utilities Commission.

Co-operation Between Manufacturers and Jobbers Emphasized

CLOSER team play between manufacturers and jobbers was advocated at a recent meeting of the New England Electrical Supply Jobbers' Club, at which the principal addresses were made by E. W. Rockafellow, general sales manager, supply department, Western Electric Company, Inc.; F. A. Wilson-Lawrenson, general sales manager Union Carbide & Carbon Corporation, New York, and A. A. Gray, advertising counsel Electric Supply Jobbers' Association, Chicago. The functions of the supply jobber were discussed by Mr. Rockafellow at the beginning of the meeting, and Mr Wilson-Lawrenson set forth the advantages of direct selling.

Mr. Rockafellow pointed out that merchant pipe has been sold through jobbers since 1904 by the National Tube Company. Today iron conduit and dry cells are distinctive jobbers' lines. The manufacturer does well to avoid mixing the policies of production and of sales, relying upon the jobbers' organizations, which buy in large quantities, relieving the producer of the cost and direction of a large traveling sales force, extra accounting and collections. The economic status of the electrical supply jobber was sometimes misunderstood during the war. Many manufacturers gave the Government jobbers' prices, but the resulting difficulties of delivery were most trying. In one case the maker of a certain wiring fitting had his goods distributed in the stockrooms of 150 jobbers in different parts of the country, and yet it was necessary under the methods adopted to send long distances for material which might have been shipped from jobbers' stocks but a few miles away. In one instance the authorities sent 3,000 miles for a five-dollar fitting which a local jobber could have supplied within a few hours.

Where the jobber was called upon to serve the Government, the speaker said, his deliveries were most helpful, and in a celebrated case which has never before been made public an order for $998,000 worth of supplies for the American Expeditionary Force was handled in record time by the co-operation of fifteen jobbers and seven or eight manufacturers. The first shipment to France was made in seven days, and in fourteen days the entire order was filled and en route.

In conclusion, Mr. Rockafellow urged more frequent meetings of representatives of jobbers and manufacturers for the interchange of viewpoints.

F. S. Price, president Pettingell-Andrews Company, Boston, said that the electrical industry faces the greatest business opportunities in its history and that through co-operation great advances can be made. He stated that the central station can make good use of the stabilizing co-operation of the jobbers and their organizations in combating socialistic tendencies, and outlined recent efforts toward better relations in New England, expressed in the formation of contact committees in the organizations of the jobbers, central stations, contractor-dealers and manufacturers.

Report of Progress on International Standards

A PRELIMINARY report of the recent Brussels meeting of the advisory technical committees of the International Electrotechnical Commission was published in the ELECTRICAL WORLD for April 17. A more complete report by the American representatives indicates that very important work was done toward the adoption of international standards by the committees on rating, definition, graphical symbols and standard voltages.

As the meeting was not a plenary one, the actions of the advisory committees are not official decisions of the International Electrotechnical Commission. They are now before the national committees for study before official action is taken in a future plenary meeting.

Rating—The advisory committee on rating was presided over by Guido Semenza of Italy. The principal results of the meeting of this committee were the acceptance of:

1. The hot-spot principle as a basis of standardization. It was agreed, however, that the working rules should contain only values of limiting observable temperature and temperature rise, and not the actual hot-spot values.

2. The classification of insulating materials. This classification is the same as the present A. I. E. E. rules with the addition of a new class, to be known as class "O," of unimpregnated cotton and similar materials.

3. The classification of methods of measurement, which is the same as that of the A.I.E.E. rules.

At the request of the American delegates the question of the terminal marking for transformers was deferred, with the understanding that the American committee would submit a scheme sufficiently comprehensive to include all classes of apparatus and machinery.

Definitions.—This committee held joint sessions with the committee on symbols, under the presidency of Prof. Janet of France. Definitions of about sixty terms were approved. These are terms which have been before the national committees for several years.

Symbols.—The Italian graphical symbols, which had been formally submitted by the Italian national committee at a previous meeting, were taken as a basis for discussion. Agreement was reached upon a list of about 100 symbols.

Standard Voltages.—Owing to variety of circumstances, a great many voltages are now in use in Europe, and in the absence of standardization work other voltages are being added.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Electrical Growth of Salina, Kan.—From an output of 619,836 kw.-hr. in January, 1919, to 1,129,391 kw.-hr. in January, 1920, is the record of growth of the Light, Power & Gas Company of Salina, Kan., a city of 15,000 people which prides itself on its good illumination and electrical displays.

Summer Course in Industrial Management.—For the fifth consecutive year the Pennsylvania State College has organized a two weeks' summer course in industrial organization and management. The course will run from Aug. 6 to Aug. 21 and be under the supervision of Edward J. Kunze, head of the department of industrial engineering of the college.

Metric System in Great Britain.—A parliamentary commission in England is collecting information on the metric system of weights and measures and will recommend legislation on the subject. Large importing and exporting houses are reported to be generally in favor of adopting the system, and a conference between the United States, the British Isles and the British dominions is suggested.

Electrification of Swedish Railroads.—The Swedish government has received from official investigators a report favorable to the electrification of all the railroads of the country, a project rendered desirable by the almost prohibitive cost of coal. Owing to the great initial outlay, however, the work would have to proceed gradually, and it is recommended that eight water-power stations be successively built, each to serve a separate district. The state railroads, it is estimated, would require about 413,000,000 kw.-hr. a year, the privately owned railroads 295,000,000 kw.-hr. and the railway to the frontier a further 90,000,000 kw.-hr.

New Use for a Desk Fan.—A correspondent of *Power Plant Engineering* has discovered a novel use for a desk fan—that of demagnetizing a watch. This is how he restored an erratic timepiece to good behavior: "I removed the armature and laid the fan on the desk in a horizontal position. Next, taking the watch and tying a string about 2 ft. long to the ring, and spinning the watch quite fast, I lowered it into the armature of the fan after turning on the current, not allowing the watch to stop spinning while it was in the armature. This happened about three months ago, and my watch is keeping as good time now as it ever did. I used alternating current at 110 volts."

Lighting Up Nicaragua.—The total population of Nicaragua is only 700,000, but its claim to progressiveness has been recently vindicated by contracts for electric lighting plants made by the municipalities of Jinotega, Bluefields, Jinotepe, Diriamba and Granada. The capital, Managua, already has an electric lighting system.

Cheap Electricity from Lignite.—According to the American Chamber of Commerce in London, a copper refinery costing £10,000,000 is to be set up at Newton Abbott, in Devonshire, on a site where the requisite electrical energy can be generated from deposits of 800,000,000 tons of lignite. There is at present no electrolytic refinery in Great Britain, 90 per cent of the copper used in British industries being imported from America. It is anticipated that the commercial development of Devonshire's lignite deposits will enable electric power to be generated so cheaply as to make it possible to supply it in bulk to all the towns in south Devonshire as well as to industries in the neighborhood.

Electric Drive at Galveston Dry Dock.—At the new two-million-dollar floating dry dock at Galveston, Tex., now in full operation, the pumping is done by electric drive. The dock is divided into two parts of unequal size. In the larger section fourteen 12-in. horizontal centrifugal pumps are driven in groups of seven by two 200-hp. electric motors of slip-ring type, with armature resistance and having controllers so arranged as to operate the motors at five different speeds. In the smaller section of the dock two 125-hp. electric motors drive eight pumps. Two-phase, 60-cycle alternating current at 220 volts is furnished from the central power station in Galveston by submarine cable laid in the channel. The twenty-two pumps operated at one time can raise a 10,000-ton ship onto the dock in one hour and in doing so will handle approximately 17,000 tons of water.

Louisville Electrical Exposition Plans.—Those responsible for the bi-state electrical exposition to be held in Louisville, Ky., on Oct. 25 to 30, inclusive, are expecting an augmented support because of the abandonment of the Chicago Electric Show this year. The executive committee, which is under the chairmanship of R. Montgomery of the Louisville Gas & Electric Company, has published a twelve-page booklet for the guidance of the organization upon which the success of the undertaking depends. The names and addresses of the members of every committee are given and the duties of each committee are enumerated. In many cases this information is supplemented by suggestions from the executive committee as to how the work might be carried out and how one committee can help another. Every committee has been made definitely responsible for its part of the undertaking, so that there should be no duplication or omission of essential details.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Business Paper Editors.—The National Conference of Business Paper Editors will convene at the Congress Hotel, Chicago, on June 4.

A. I. and S. E. E., Philadelphia Section.—The annual outing of this section will be held at Brown's Mills in the Pines, N. J., on Saturday, June 5.

Association of Municipal Electrical Utilities of Ontario.—The semi-annual convention of this association is to be held at Niagara Falls on June 10 and 11, instead of June 17 and 18, as formerly announced.

Florida State Association of Electrical Contractors and Dealers.—W. H. Satchwell of Jacksonville was elected president and J. G. Spencer, Jr., secretary of this association at its first meeting, held for organizing purposes on May 7.

Electrical Co-operative Convention.—Electrical manufacturers, dealers, contractors, jobbers and central-station operators are to meet in a "co-operation convention" at the Hotel Vancouver, Vancouver, British Columbia, on May 31 and June 1.

New York Electrical Society.—This society held a meeting in the Engineering Societies Building on Wednesday last, May 26, at which Kenneth S. Johnson, engineering department of the Western Electric Company, made an address on "Elementary Phases of Telephone Transmission Engineering," illustrated with lantern slides.

Chicago Section, I. E. S.—At the last meeting of this section of the Illuminating Engineering Society for the 1919-1920 season, held at Lewis Institute on May 13, Prof. F. C. Caldwell of Ohio State University spoke on "Good Lighting in the Schools." The following officers were elected: Chairman, J. L. Stair; vice-president and secretary, J. J. Kirk; managers, Frank F. Fowle, Edwin D. Tillson, F. D. Benson, John M. Foster and A. F. Hunt.

Chicago Section, A. I. E. E.—J. R. Bibbins, chairman-elect of the section and supervising engineer of the Arnold Company, read a paper on city transportation problems before a largely attended joint meeting of this section of the Institute and the Western Society of Engineers on the evening of May 12. As chairman of the section next year Mr. Bibbins will have associated with him M. M. Fowler as secretary and an executive committee consisting of A. F. Riggs, C. A. Keller, F. F. Fowle, S. A. Rhodes and E. J. Blair.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Employer Responsible for Flywheel Accident.—Injury to an employee through his clothing catching on the key which fastened a flywheel to its shaft near a pulley that he was adjusting constitutes, in the judgment of the Supreme Court of Oregon, a liability for the employer, who, under the employers' liability act, is required to use every precaution not in impairment of the efficiency of the machinery to protect employees. (188 P. 700.)

Powers of Florida Railroad Commissions.—The Supreme Court of Florida in giving judgment in a railroad rate case declared that where it is doubtful whether a statute authorizes a municipality to fix rates for a public utility company the doubt must be resolved against the city, but that this rule has no application to the Railroad Commissioners of the state, an act of 1913 providing that "all doubts as to their jurisdiction and powers shall be resolved in their favor." (84 So. 61.)

Unconstitutional Provision of Oklahoma Corporation Commission Law.—In two cases carried from Oklahoma to the United States Supreme Court that court found that a provision of the law establishing the Corporation Commission of Oklahoma which was construed by the Oklahoma Supreme Court as authorizing no review of the orders of the commission fixing rates except by an appeal in contempt proceedings for violation of the order, which violation might be punished by a penalty of $500 a day, contravened the Fourteenth Amendment of the United States Constitution because of this absence of an opportunity for a judicial review. [Since the case arose the Legislature of Oklahoma has amended the law to permit appeals to the State Supreme Court.] (40 S.C.R. 338.)

Definitions Affecting Watercourse Development.—A channel formed by water which previously spread over the land and disappeared into the ground but which was artificially concentrated and has continued to exist for more than thirty years may, the Supreme Sourt of California holds, be considered as a watercourse wholly natural in origin. A channel with defined bed and banks and habitually used by water passing down as a collected body or stream in seasons during which streams in the region are accustomed to flow is a watercourse in the legal sense, although it may be dry except in the winter and spring and may be dry at intervals during those seasons. Surface waters are those which fall on the land from the skies or arise in springs and spread over the surface of the ground without being collected into a definite body and do not include waters already gathered into a definite body flowing as a stream in a watercourse. (188 P. 554.)

Missouri Law of Contributory Negligence.—In finding for the plaintiff in a suit against the Union Electric Light & Power Company of St. Louis for damages because of the death of a fireman who fell from a platform 12 in. wide and 12 ft. above the floor, from which he was required to reach dampers 6 ft. above the platform, the platform having no railing and being badly lighted, the Supreme Court of Missouri observed: "That the deceased assumed the risk probably is the law in most jurisdictions. It is not in this one. The doctrine of this court is that an employee only assumes such risks in respect to the place where he is put to work as are incident to the service after the employer has performed his duty by using care to provide a place of reasonable safety; and although the danger of the place may be obvious, if this is due to lack of care on the part of the master to furnish a safe place, the servant does not assume the risk." (219 S. W. 902.)

What Constitutes a Competing Company—Compulsory Service.—An important decision has been handed down by the Supreme Court of North Carolina in the suit of the Salisbury & Spencer Railway Company against the Southern Power Company to enforce service. The main points in the decision are: (1) A hydro-electric company cannot, as a public service corporation, be compelled in ordinary circumstances to supply a competitor of like character with the material necessary to enable the latter to discharge its duty to the public; (2) an electric street railway and a retailer of electricity engaged in supplying the citizens of municipalities with energy to light their residences and for other private purposes are not competitors of a hydro-electric power company engaged in wholesaling electricity and so can compel the power company to supply them; (3) when a hydro-electric company began to sell its energy to smaller corporations for purposes of resale and distribution among the public, every such retailing corporation obtained equal right to be served and the hydro-electric company must not discriminate, though it need not necessarily sell to all at the same price; (4) if, in mandamus proceedings, it shall be decided that corporations engaged in retailing electricity are entitled to a decree compelling a hydro-electric power company to furnish energy required by them, then, in case the parties to the action cannot agree on a price, the matter can be taken before the Corporation Commission and the defendant power company can be required by the court to furnish electricity at the rate fixed by the commission. (102 S. E. 625.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Failure to Set Up Depreciation Reserve Condemned.—In passing upon a recent telephone case the Wisconsin Railroad Commission took occasion to emphasize the point that a public utility is not justified in placing the cost of past depreciation on its future subscribers where the amount which should have been reserved for depreciation has been expended on dividends.

Rates Less Than Cost and Free Service Are Discriminatory.—In granting an increase of rates to the Mission Range Power Company, the Montana Public Service Commission has asserted that a wholesale rate less than cost is discriminatory, as is also free service to stockholders and employees. Consumers, the commission says, are not entitled to rates lower than necessary to produce a fair return on a utility company's investment.

Capitalizing Cost of Developing Business.—The cost of developing a utility business measured by early losses is to be capitalized only in a case in which the company has established its business and is earning a fair return, according to a recent finding of the Public Service Commission of New York, Second District, for otherwise the less the success of the company the greater would become its estimated value for rate-making purposes.

A Company Without a Franchise Is Not in the Field.—A public service company not having a franchise to operate in a particular town cannot, according to a decision of the New York State Public Service Commission, Second District, invoke, as against a company desiring to serve such town, the rule that it is against public policy to permit a competing company to enter a field already occupied by an existing corporation able and willing to provide adequate service, since it cannot be said to be already in the field.

Electric Customers Must Not Be Required to Make Up Gas Deficiency.—In dismissing without prejudice the application of the Public Service Company of Northern Illinois for increased gas rates in forty-eight communities, the Illinois Public Utilities Commission reiterated the opinion previously expressed by it that to permit gas consumers to receive their service at less than cost while consumers of electricity are required to make up the deficiency would be contrary to the spirit of the public utilities commission law and to decisions of the United States Supreme Court.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

W. S. Finlay, Jr., who in 1917 was made superintendent of motive power of the Interborough Rapid Transit Company, New York, has resigned to become vice-president of the American Water Works & Electric Company. Mr. Finlay was born in Hoboken, N. J., in 1882, and began his education in the public schools of Brooklyn. He was graduated in mechanical engineering at Cornell University in 1904. Soon after graduation he entered the employ of the Interborough Rapid Transit Company as an assistant on the staff of H. G. Stott. His early work in the company was identified with the construction of the Fifty-ninth Street power station. Later he was utilized by Mr. Stott in doing experimental and research work in connection with schemes for the development of that

W. S. FINLAY, JR.

station and the promotion of its efficiency. In 1907 he was placed in charge of construction work arising from the requirements of increasing plant load. In 1909 Mr. Finlay left the Interborough, continuing in engineering work for a brief period with the New England Engineering Company. Subsequently he became associated with his father, W. S. Finlay, in commercial work, returning to the Interborough in 1915 to take charge of the installation of turbines and auxiliary mechanical equipment necessitated by the extensions to the subway and elevated systems. Upon the death of Mr. Stott, Mr. Finlay was appointed as his successor as superintendent of motive power. In that capacity he, in addition to supervising operation of the power-generating system of the company, had charge of the engineering and construction work coming within the scope and control of the department, this recently involving additions of power output capacity amounting to 165,000 kw.

Frederick G. Cottrell, chief metallurgist, Bureau of Mines, Department of the Interior, on May 5 was appointed by President Wilson to be director of the Bureau. He will succeed Dr. Van H. Manning, whose resignation will take effect June 1.

R. G. Justus of the Sapulpa (Okla.) Electric Company has been appointed local manager at Bristow, Okla.

A. L. Burbank, of Pueblo, Col., has been made auditor of the Northern States Power Company at Sioux Falls, S. D.

R. W. Davenport of the United States Geological Survey is making a trip through Idaho, Utah, Washington, Oregon and California to study problems concerning the administration of water powers on public lands in those states.

R. F. Gooding, recently with the Buffalo office of the Westinghouse Electric & Manufacturing Company as sales engineer, has become associated with Mees & Mees, consulting engineers and industrial architects, at Charlotte, N. C., as electrical engineer for the firm. Mr. Gooding was graduated in the course in electrical and mechanical engineering at Clemson College, South Carolina, in 1905, after which he spent four years with the Westinghouse Electric & Manufacturing Company as an engineering apprentice and draftsman. He then became assistant electrical engineer of the Duquesne Light Company at Pittsburgh, after which he returned to the Westinghouse company as designing engineer on power stations, substations and switchboards. In 1915 he represented the company in England as commercial engineer on switchboards and protection apparatus. Later he became assistant engineer in the station construction department of the Philadelphia Electric Company, returning to the Westinghouse Electric & Manufacturing Company as salesman and engineer in 1918. As electrical engineer for Mees & Mees, Mr. Gooding will be responsible for the electrical part of all the new developments of this firm. Mr. Gooding has contributed several articles on the calculation of short-circuit currents in large networks to recent issues of the ELECTRICAL WORLD.

Walter L. Mulligan, for the past eighteen years manager of the United Electric Light Company, Springfield, Mass., has been elected treasurer of that company, to fill the vacancy caused by the recent death of W. A. Lincoln, who had served as treasurer for more than thirty years. Lorenzo J. Scott, who has been assistant manager for several years, has been appointed manager to fill the vacancy caused by Mr. Mulligan's promotion.

Alfred C. Jordan, heretofore superintendent of equipment for the Cumberland County Power & Light Company, Portland, Me., has resigned to accept a similar position with the Elmira (N. Y.) Water, Light & Railroad Company. Mr. Jordan's new duties will include the superintendency of the railroad shop and overhead lines of the light and railroad departments of the company. Before joining the engineering staff of the Cumberland County Power & Light Company in 1916 Mr. Jordan was for some years associated with the Elmira company.

L. H. Newbert, who was elected president of the Pacific Coast Section of the N. E. L. A. on May 17, is manager of the commercial department of the Pacific Gas & Electric Company. Mr. Newbert joined that company in 1900

L. H. NEWBERT

and was in charge of power and lighting sales in the district around Marysville. Later he was transferred to the San Francisco office as head of the sales department. When the commercial and sales departments were combined Mr. Newbert was appointed head of the new commercial department. During the past year he has been closely identified with the California Electrical Co-operative Campaign in the capacity of chairman of the advisory committee and at the recent N. E. L. A. convention he presented the report of the committee on co-operation in industry, of which he was chairman.

Dr. T. S. Taylor, who during the last three years was research physicist in the research laboratory of the Westinghouse Electric & Manufacturing Company, has recently left this company to become industrial fellow, Magnesia Association, at the Mellon Institute of Industrial Research, Pittsburgh. Dr. Taylor took his undergraduate work and also his doctorate in physics at Yale University, receiving the degree of Ph.D. in 1909. His recent researches in connection with heat transmission as applicable to the disposition of heat from electrical machinery and also through insulation used in the conservation of heat have attracted wide attention among electrical engineers.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Washing-Machine Makers' Output Badly Curtailed

WASHING-MACHINE manufacturers were just beginning to get larger and more frequent supplies of wringers, motors, sheet steel and copper, and even crating, when the transportation tie-up made conditions worse than they were before. Lack of these materials is seriously curtailing output of washers and in some cases causing shutdowns. This condition would be very serious for manufacturer, jobber and dealer were it not that the available credit for the time-payment sales of washing machines is barely sufficient to finance the sale of the present output of machines, and credit may be curtailed still further.

It is true that the shortage of wringers alone is holding up a great many of these manufacturers today; furthermore, some of them have been obliged to shut down their plants because of this one lack, shipments on which have been reported seven months behind.

A number of the manufacturers are figuring on foreign business, but the present rate of exchanges and the subnormal factory production makes it practically impossible to enter the foreign field at the present time. It is understood that one manufacturer recently had to refuse an export order of 12,000 washing machines because of the conditions of factory output. This market, however, is expected to improve to a great extent as soon as these conditions have been overcome.

Credit Limits Electrical Production That Can Be Marketed

MANUFACTURERS of diversified electrical products have come to believe that the forced limitation of their output during the past year or more is a blessing which is in a large measure responsible for the strong position of the industry as a whole today. Larger production of electrical apparatus and merchandise at the prevailing high-production cost would undoubtedly have further expanded the credit structure at a time when efforts were being made to reduce the existing inflation. Up to a few months ago bankers would no doubt have financed electrical manufacturers, jobbers and dealers to permit them to handle an increased production, and it was generally considered to be very unfortunate that the industry was unable to buy or make all the goods that could be sold.

However, now that loans are being called in and credit is being curtailed, manufacturers are glad to have money in the banks instead of having it tied up in new construction. Electrical contractors and dealers consider themselves fortunate to be able to keep up their business and their prices at a time when in some other lines stocks have to be disposed of at a sacrifice.

Time payment terms, on which the higher-priced household devices are largely sold, have been shortened, and dealers are experiencing difficulty in financing the sale of these devices in the quantities now being furnished them. Some industrial customers could have bought more electrical equipment if it had been available, but the central stations as a class could not have financed the new power-plant and distribution equipment necessary to furnish the power for its operation.

It is not so much the number of units produced as it is the cost of production that is bothering thoughtful manufacturers. What the electrical and practically every other industry needs is a large production of goods at a cost which will permit them to be sold at a profit when the deflation of the credit structure has been completed. It is realized that credit may get tighter before it gets easier, and if that proves to be the case further decreases in the production of high-cost goods would help the general credit situation.

Stoker Makers Face Curtailment Unless Tie-Up Ends

DEMORALIZED freight conditions are particularly serious to manufacturers of stokers. In several cases the rapidly accumulating stock in warehouses is becoming so great that production will soon be reduced or cease altogether unless the product can be moved. While orders are plentiful and show no signs of let-up and while the raw-material situation is not quite so acute as with other industries, because most of this material is in the nature of bulk raw material such as iron ore, etc., there is little use in tying up money in equipment that cannot be placed in the customers' hands.

Stoker men are rather optimistic as regards the future of the business. While setting their houses in order to meet any possible contingency in regard to trade conditions, they do not anticipate that the effect of possible depression will be so serious in their industry as in others. As coal costs mount higher and higher and delivery conditions become worse, less argument is needed for the sale of mechanical firing devices. Appearances point to the fact that they are rapidly taking their place among those necessities which even in a time of commercial depression would be salable because of economic factors.

Slight Improvement Shown in Traffic Movement

MANUFACTURERS of electrical apparatus report slightly better movement of materials this past week. While freight yards and sidings are still badly congested and strings of cars may be seen stretched out for long distances along rights-of-way, there has been a gradual unloading of freight in the yards and a release of the cars to the road again. Although long trains of empties have been sent West for grain shipments, manufacturers are finding a few cars here and there wandering in to their sidings, and they are able to relieve some of the congestion of piled-up finished products in their warehouses. A great part of the material which jobbers are receiving, however, seems to be coming from gradually opening yards.

Economic Aspects of General Commodity Retail Price Slashing

IF, AS was stated at the Del Monte convention of the Electrical Supply Jobbers' Association, the downward trend of the market will take its cue first from food products and secondly from clothing and the other personal commodities, then it would not be amiss to look at the market conditions in fields other than the electrical. In the electrical market, it is true, prices are still advancing

Strange as it may seem, there is no tendency to cut retail food prices except in the fresh vegetable line. Canned and package goods show no drop nor do meat and meat products. Wholesale prices, however, on many of these lines, especially live meats, have been receding for some time. In virtually every line the farmer is receiving less for his produce.

In the clothing and house-furnishing lines retail prices have been subject all over the country to what seemed almost hysterical slashing, cuts of 20 to 33 per cent being commonly reported. The movement, which started in the East, spread like wildfire and quickly brought about another spending orgy.

After the novelty of the first week or ten days passed off the excitement began to subside, and retail buyers are now taking the drop for granted. It is doubtful, however, if the average retail buyer can again be lured by higher prices. There is a real demand for reductions which is quite contrary to the spirit of the people ten months ago.

The National Association of Manufacturers in recent convention urged its members to work to bring about a reduction in the prices of commodities. Others feel the same way, but there is still a strong feeling that falling prices are all right for the other fellow's products. This feeling, which it must be admitted has been evident in certain electrical lines, is having its retarding effect.

Retail prices of electrical goods, including portable lamps and shades and those socket devices bearing the retailers' nameplates and even some standard lines, have been cut. In one case vacuum cleaners made in a prominent Middle Western factory were disposed of at around $17.

To what extent this wave of retail buying stimulated by cuts in price will affect the market is not definitely known. It is certain that further slashes will be arrested for the time being. Also it seems to indicate that any orderly downward trend is not to be expected.

It would not be surprising, therefore, to see thhe market act something like a bouncing tennis ball—deep slashes, slight recovery, another slash and recovery, etc., the average all the while showing a definite downward tendency.

Metal Market Situation

A LIFELESS condition rules the metal markets. Transportation embargoes are still a serious consideration in the movement of raw materials, and refiners' supplies are at a low ebb. Consumers have no desire to buy under these conditions. Producers of copper are quoting on a merely nominal basis at 19 cents, while the outside market is weaker, with offerings to sell at 18.25 cents delivered for June. The copper and brass scraps are ¾ cent to 1 cent lower than they were two weeks ago, and buying is at a standstill. London copper prices are about £17 below the level of May 12.

Zinc has receded about twenty points since last week and producers are unwilling to meet this new level of 7.90 in New York.

Better supply of lead is expected in another month's time; meanwhile, the outside market is making light sales at a price about thirty points above the 8.50-cent level of the largest producers.

NEW YORK METAL MARKET PRICES

	May 19	May 25
Copper	£ s d	£ s d
London, standard spot	98 5 0	98 5 0
	Cents per Pound	Cents per Pound
Prime Lake	18.75	18.50 to 18.75
Electrolytic	19.00	19.00
Casting	18.25	17.75
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	8.50	8.50
Antimony	9.37½	9.00
Nickel, ingot	42.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.10	7.90
Tin	54.25	51.25
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	16.00 to 16.50	15.75 to 16.00
Brass, heavy	9.00 to 10.00	9.00 to 10.00
Brass, light	8.00 to 8.50	8.00 to 8.50
Lead, heavy	7.00 to 7.25	7.00 to 7.25
Zinc, old scrap	5.00 to 5.25	5.00 to 5.25

THE WEEK
IN TRADE

DEMAND for electrical goods is heavy, although a slight reaction on account of price cutting in other industries has slowed up orders during the past week. There has been no price cutting in the electrical field, according to reports received up to the time of going to press.

Jobbers find it more and more difficult to transact business, on account of badly depleted stocks, although shipments now en route will enable them to clear up a large majority of back orders. Poor crop conditions in the South have caused a slight falling off of sales in the country districts. Freight is being delivered in greater volume in New York, Chicago and Boston than heretofore, and, in addition, Pacific Coast points are commencing to receive stocks which have been en route for many weeks. With prospects of greatly improved shipping conditions in June as compared with May, jobbers are preparing to receive and bill out a heavier volume for June to make up for the slack periods during April and May when shipments were poor.

Price changes are noted this week on fuses and on small sizes of alternating-current motors.

NEW YORK

Jobbers, owing to a continued curtailment of freight shipments, have been forced to mark time during the past week. Demand has fallen off, influenced to some extent by the price cutting in retail shops on non-electrical goods. In a representative case one jobber's daily orders fell off from an average of fifty-five orders to thirty, covering a period of several days. There has been no indication of price cutting in electrical goods except in one or two instances in large department stores where the name of the store appears on the appliance sold.

Commercial associations and railway executives are cooperating to improve shipments and clear up the congestion of freight in the metropolitan district, and from reports at the time of writing conditions should be much better during the next few weeks. This will enable the filling of a large number of back orders still on hand and will bolster up sales for the latter part of May and for the month of June. Commercial building plans are going ahead in good shape from the reports of large new structures appearing daily.

Wire.—Many shipments of rubber-covered wire, especially No. 14, have brought jobbers' stocks back to normal or above. The larger sizes are in fair demand, although sales on the smaller sizes are much better. No. 14 is quoted at $11 to $12 per 1,000 ft. in lots of 5,000 ft. or more.

Lamps.—Jobbers' stocks are in fair shape, with shortages reported from certain sources in the 75, 100 and 200-watt sizes. Many shipments of smaller sizes were received during the week.

Conduit.—Conditions remain unimproved, the shortage being acute. The ¾-in. and 1-in. sizes are scarce, although small stocks of ½-in. and the larger sizes are known to exist.

Flexible Armored Conductor.—There is little or no stock to be had. Jobbers have trucked some from nearby points, but it has all been disposed of in short order. A considerable amount is en route, but no surplus can be expected for many months. Prices vary, but No. 14 double-strip is quoted at $120 per 1,000 ft. in coil lots.

Fuses.—Demand continues steady with stocks slightly below normal. An increase of 5 to 10 per cent on ordinary fuses has been made by several manufacturers.

Non-Metallic Flexible Conduit.—Stocks are low and few shipments are being received. Prices for the ½-in. and ⅝-in. are $37.50 and $35 per 1,000 ft. in lots of 1,000 ft.

Porcelain.—Knobs, tubes and cleats are being received in quantities by truck. Stocks are low, generally, and prices fluctuate.

Outlet Boxes.—Stocks of the popular sizes are scarce. Manufacturers have been unable to get raw materials and deliveries have been held up accordingly.

CHICAGO

Trade comment this week is of little value, as the market is so circumscribed by outside controlling factors that its natural trend is difficult to determine. New business with both the jobber and the manufacturer has unquestionably fallen off considerably, but just how much of this is due to the general trend of business and how much to extraordinary circumstances is unknown. Every one is as busy as ever. Activity now is confined largely to attempts to obtain goods already on order rather than to the placing of new orders. Transport troubles have been mitigated to a slight degree only, if at all, and the maintenance of stocks is not possible.

Delays are by no means uniform. Some manufacturers, able to obtain all needed material except some one essential, are piling up constantly increasing volumes of partly finished goods, thus augmenting their already heavy inventories. The one relieving feature is that the railroads are generally accepting outbound consignments.

Reductions in operating force and in hours are being made by some manufacturers on account of material shortages, and if fuel conditions, now getting serious, are not soon relieved, extensive shutdowns may be anticipated. All companies having transmission lines, either power, telephone or telegraph, are having great difficulty in obtaining sufficient supplies for proper maintenance and for the completion of extensions under way. New construction work is out of the question.

Retail trade continues excellent. Great activity is being shown by the large department stores in the sale of washing machines and vacuum cleaners. Tight money is presenting a difficulty in the way of financing retail campaigns on the deferred-payment plan.

Motors.—Dealers' stocks are getting in worse shape every day because of the continued non-arrival of motor shipments. A 10 per cent advance is noted, effective May 15, on Century Electric Company's output of single and polyphase automatic starting motors, split-phase motors and fans.

Compensators.—Local supply of compensators is as scant as that of motors. Unfortunately, the compensators in stock frequently fail to match motors on hand, and in many cases the motors are being shipped with starters to follow. It is understood that sufficient units are in transit to supply these unfilled orders, but the arrival is uncertain. Stocks will undoubtedly be badly broken for some time.

Transformers.—Previously reported heavy demand has left only certain sizes of distribution transformers obtainable for immediate delivery. Some complaint is heard concerning excessive losses on station transformers of recent make, because steel used in construction did not conform to established standards.

Fuses.—New prices are anticipated on D & W fuses, both cartridge and refillable types, involving slight increases on most items of the line.

Friction Tape.—With demand less than has been anticipated, stocks in all grades are now well maintained. Current price on high grade is 90 cents per pound in 1-lb. to 5-lb. quantities, 78 cents from 6-lb. to 25-lb. and 75 cents in larger lots. Similar quantities on medium grade are quoted at 78, 70 and 60 cents per pound.

Northern Cedar Poles.—The strike in the producing fields of the North has ended in a satisfactory compromise. All yards are reported working or going to resume immediately. Some shipments are going forward and stocks are getting in good shape. Prices are steady.

Flatirons.—Western Electric 6½-lb. irons, previously priced at $7.50, have been advanced to $8. Those makers of irons who have not recently advanced lists are expected to do so in the near future. Under heavy demand stocks remain in good shape.

Ironing Machines.—Little sales effort is being expended on ironing machines because factories are able to supply them in limited quantities only. They are receiving ready favor wherever they are featured.

BOSTON

An enormous volume of orders continues to flow into the hands of the jobbers. One leading house reports gross sales in dollars 75 per cent ahead of last year to May 1, notwithstanding delivery difficulties. Stocks are very spotty, the supply of rigid conduit and small motors being extremely low. Collections are fair. Prices are stiffer on motors, N.E.C. approved fuses, meters and metallic flexible conduit. Deliveries are improving slightly as the railroads relax embargoes on material traveling outside New England. Small shipments are coming through better, and orders placed in the early winter are being received. Building construction continues active. Cool and rainy weather has retarded the retail sale of seasonal appliances somewhat but has greatly increased the supply of hydroelectric power in New England. Labor conditions in electrical manufacturing plants show improvement.

Motors.—Wagner single-phase motors have increased from 5 to 10 per cent in price through discount changes in sizes of 1 hp. to 7.5 hp. Century motors are up 10 per cent. The demand for small motors is tremendous. Deliveries are quoted from sixteen to twenty weeks. The Boston market is practically bare of single-phase motors.

Fuses.—Leading makes of approved fuses are up 10 per cent. Stocks are in good shape, but some sizes are low.

Meters.—Trade is brisk and much house wiring is under way. Prices are about 10 per cent. higher than last month. No one is bragging about his stock unless to selected customers. Raw material is flowing a bit more freely into the factories.

Lamps.—By careful handling trade requirements are being met reasonably well. One distributer has a stock of 500,000 lamps in Boston but is husbanding deliveries, keeping close to immediate needs. The outlook is for an extraordinary year's business.

Fans.—Stocks act as though "frozen in." Jobbers vary in their holdings, but immediate needs will be promptly met. Complaint was heard Monday as to failure to receive some shipments from Middle Western factories in time for early summer trade. A representative 12-in. straight fan lists at $29.60, with 25 per cent off in lots of twenty-four or less.

Wire.—Prices are steady and the supply good. Rubber-covered No. 14 brings $11.75 per 1,000 ft. in 5,000-ft. lots. Weatherproof wire No. 6 is quoted 34 cents per pound reel lots. Bare base, 24 cents.

Flexible Armored Conductor.—Several carloads have been received within a few days. No. 14 single-strip brings $110 per 1,000 ft. in 1,000-ft. lots. The worst appears over in this class of material.

Non-Metallic Flexible Conduit.—Prices are steady at $35 per 1,000 ft. for ⅝-in. and $38.50 for ½-in., in 1,000-ft. lots. Stocks are better, though this material as a rule goes into service not long after it reaches the distributer.

"Nail-it" Knobs.—Sales are going through better, but rail deliveries are trying. One jobber has had 130 barrels en route from New York for the past six weeks. Motor-truck shipments at high cost resulted. In barrel lots the going price is $31.50 per 1,000. A shortage in tubes is noted in some quarters.

Flexible Metallic Conduit.—The discount has been cut five points off double list in coil lots.

ATLANTA

The latest report of the Commissioner of Agriculture for Georgia dealing with the crop outlook for the state is rather pessimistic. Only a small percentage of the cotton acreage has been planted, while such cotton as has come up has been severely damaged by the weather. Reports from the middle portion of the state are that heavy planting of food products will be substituted in a great number of instances for cotton. This condition has caused some slackening in purchases in the rural communities, and one jobber who deals directly with the agricultural and rural trade in the lines of farm-lighting outfits, small generator sets, etc., reports a noticeable slackening in sales and an unusual amount of cancellations. Other jobbers, however, report conditions as satisfactory, business for the month of May to date having exceeded that for a corresponding period in April.

Several of the larger firms are tightening up on the extension of credit and are refusing to ship incoming orders except on sight draft bill of lading attached, unless purchaser will liquidate outstanding accounts. Collections in general are reported good, with the exception, however, that the contractors in the small towns are slower than usual in the payment of their accounts. This is also true of the hardware dealers handling electrical specialties as a part of their business.

Meters.—Considerable difficulty is being experienced in obtaining meters in sufficient quantities to meet the demand. While the smaller meters are still available, shipments are lengthening, and in the case of the larger sizes, particularly the 2,300-volt type, they are quoted at three to four months.

Distributing Transformers.—The transformer shortage, especially in sizes of 15 kva. to 50 kva., has become quite severe, and no stocks of these sizes are in the territory to supply an insistent demand.

Motors.—The motor situation shows no improvement, in fact, shipments as at present quoted are considerably longer than was the case thirty days back. There are virtually no stocks of new motors in the territory and the supply of the second-hand variety has been exhausted by the insistent demand. Single-phase deliveries are thirty to forty weeks.

Sewing Machines.—The expected activity in this specialty has failed to materialize and jobbers report an unsatisfactory turnover of this article. Plentiful stocks are on hand and jobbers are hoping that the opening up of the real spring weather will stimulate movement.

Washing Machines.—The demand for washing machines continue to show an increase. Recent shipments have put stocks in materially better shape than they were thirty days ago.

Lamps.—Railroad embargoes are beginning to be felt in the lamp field. One of the largest jobbers is completely out of the 100-watt sizes, and the 75-watt size is becoming quite scarce. Shipments are coming through so slowly that the very brisk demand will badly deplete local holdings unless conditions improve immediately.

Wire.—An acute shortage in popular sizes of weatherproof is felt throughout the section. The large sizes of rubber-covered are on hand in fair quantities, but No. 12 is very hard to obtain. Prices, rubber-covered, 28 cents; weatherproof, 29 cents.

SEATTLE—PORTLAND

The past week has shown a gradual decrease in the volume of business transacted in Seattle by electrical jobbers. Retailers also report business slowing up, although the decrease is not nearly so noticeable as in the case of jobbers. This condition is attributed by most jobbers to high prices and the general feeling of uncertainty which is more or less prevalent in this section. The incoming freight situation shows no improvement, consequently stocks, generally speaking, are in a bad shape.

Building activities in Washington show a sharp increase in new construction either under way or ready to proceed. Business in all lines, from the manufacturer down to the retailer, reports a continuing tendency downward. No price changes have been noted during the past week. The collection and credit situation remains practically unchanged. There is considerable hesitation about starting much new work of any magnitude, and the inability to procure stock from the East seriously hampers business. There is a tendency among retailers and contractors to contract gradually rather than expand at the present time, materially reducing their overhead in an attempt to forestall the possible business depression.

Motors.—Stocks, generally speaking, are shot to pieces, in the face of a steady demand especially for the smaller sized motors. Fractional sizes are practically unobtainable, and no hope of immediate relief is entertained even by the optimistic jobbers.

Schedule Material.—In the face of active demand, which is showing a decrease, jobbers' stocks are nearing total depletion, with no immediate prospects of improvement. Shipments are slow, uncertain and exasperating.

Flashlights.—Demand is showing an increase, but stocks are spotty with shipments coming in slowly. Battery supply is running low. Prices show no change.

Friction Tape.—An insufficient quantity is on hand to supply the demand, which is brisk. Shipments are coming through slowly and irregularly. Prices are trending upward.

Lamps.—Local requirements are being well handled, but no excess stocks can be built up because of light shipments. In Puget Sound cities the demand for lamps for residences is heavy, but industrial sales are showing a continual dropping off.

Heating Devices.—Delivery dates are exceedingly uncertain and prices are trending upward. Sales are holding up well, although the past week witnessed a noticeable decrease over the first weeks in May.

Sewing Machines.—The movement during the past ten days shows a gradual decrease in orders. Spring weather is expected to stimulate demand. A recent shipment will care for immediate demand, but stocks as a whole are in poor condition. An early increase in prices is anticipated.

SAN FRANCISCO

Larger units of building are reported, but the number of jobs is somewhat smaller. Counter business and device sales have dropped off appreciably. As an indication of the trend of public expectation, all large department stores are announcing special sales to clear off their stocks before a drop which they seem to expect. Buyers announce that they are held to low budgets. Banks have decreased their loans to such sources, and the sales have been successful.

Collections have lengthened from five to ten days over the good mark of forty-five days set earlier in the year. Electrical credits, too, have tightened and are cautiously extended.

Wire.—Standard No. 19 twisted inside telephone wire is now selling for $15.50 per 1,000 ft. in 1,000 ft. lots. Stocks are fair and the demand is good because of the completion of certain big jobs requiring the runs.

Bell-Ringing Transformers.—A slight drop in price has taken effect, the standard styles now selling for $1.35 each in lots of a dozen, and about 10 per cent higher for singles. The call is good with sizeable export orders reported.

House Goods.—Annunciators, push-buttons, door openers etc., have jumped considerably in price, the average advance being 25 to 30 per cent. These articles are in good demand. The market for large return-call annunciators seems to have disappeared.

Non-Metallic Flexible Conduit.—Prices on non-metallic flexible conduit are constant. Stocks are poor, however, most jobbers having just a small quantity on hand for speed orders. A few customers who purchased large shipments are doling their surplus out among less fortunate competitors.

Insulating Tape.—Tapes have jumped about 15 per cent, friction now selling for about 70 cents per pound in 100-lb. lots, 8-oz. rolls. The demand is, of course, steady, and stocks are good.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

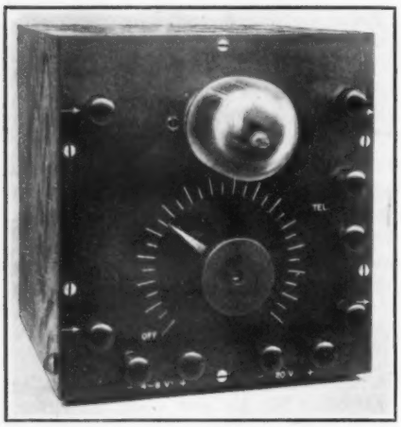
Heavy-Duty Toggle Switch

Harvey Hubbell, Inc., Bridgeport, Conn., has recently put on the market a heavy-duty toggle switch, No. 8102, of the surface type. It has a round base, 2⅝ in. in diameter, which can be furnished either slotted or solid and in composition or porcelain. A simple sturdy mechanism is employed, designed to make it prompt and positive in action. The switch is rated by the Underwriters at 10 amp., 250 volts.

10-AMP. TOGGLE SWITCH

Audion Vacuum Tube Detector

The International Radio Telegraph Company, 326 Broadway, New York City, is manufacturing for experimental and laboratory use a single-tube detector, type RTD-102-A. The size of its bakelite panel is 6 in. x 6¾ in., and the instrument is made for interconnection and combination with any desired form of arrangement of receiving apparatus, according to the manufacturer. This type is intended for use with the Moorehead-deForest-Marconi Class I (soft) detector tubes. The sockets are of the standard Army-Navy VT four-contact receiving-tube design, and the instruments are so constructed that other vacuum tubes may be used. It is designed so that there will be little or no distortion inherent in the instrument



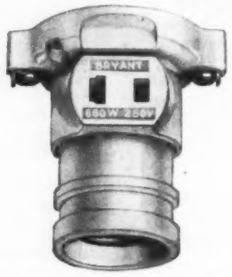
SINGLE-TUBE DETECTOR OF UNIT TYPE

and is said to be useful for receiving radio-telephonic messages.

Standard grid condensers and grid leak-resistance units are furnished with each outfit.

Spartan Current Tap

For use in connection with the sockets and bases of the interchangeable porcelain line, the Bryant Electric Company, Bridgeport, Conn., has recently produced a current tap known as Cat. No. 78. This device is made of porcelain, glazed finish, and is designed for convenient insertion between the porcelain base or cap and the socket, to provide an extra outlet for connecting ex-



TAPS CURRENT FROM PORCELAIN SOCKET LINE

tension-cord devices. The tap part is of standard Spartan type for use with any standard parallel-blade plugs.

Battery Bell

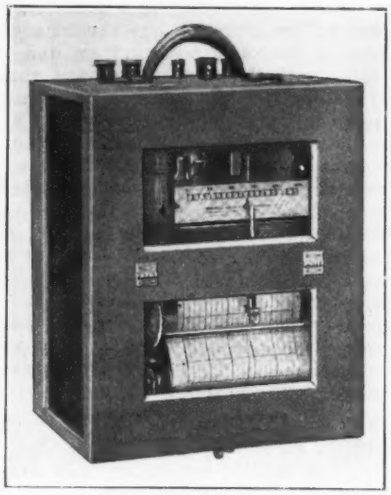
Battery bells with 2½-in. and 3-in. nickel-plated gongs, for use as transportable calling devices, have been

DRY BATTERIES ARE IN THE BASE

placed on the market by the Electric Signal Manufacturing Company, Inc., 31 Tremont avenue, Orange, N. J. Two-cell and three-cell flat-type dry batteries are used with the equipment.

Motor-Operated Switchboard and Portable Graphic Instruments

Improvements have been made by the Westinghouse Electric & Manufacturing Company on its line of type M switchboard and portable graphic instruments. Heretofore pens were driven by solenoids damped by dash pots, whereas they are now driven by a small motor actuated by contacts in the main circuit. Damping is accomplished by means of permanent magnets on an aluminum disk attached to the shaft of the pen-operating motor.

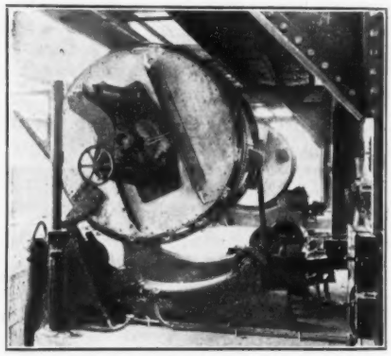


PEN IS MOTOR DRIVEN

The external resistance is in a compact unit form so that interconnections can be made to allow any instrument to operate on a control voltage of 110 volts direct current or 25 cycles or 60 cycles alternating current. A 220-volt, 25-cycle or 60-cycle control resistor may be used.

Rocking-Type Electric Brass Furnace

For pouring directly into molds in rolling mills, foundries, smelting and refining plants, the Detroit Electric Furnace Company, Detroit, Mich., has developed an addition to its series of rocking furnaces. The equipment is designed to eliminate certain metal losses due to cooling. This direct-power type furnace is made in 500-lb.,



METAL MAY BE POURED DIRECTLY INTO MOLDS

1,000-lb. and 2,000-lb. sizes, and these capacities may be increased 50 per cent, the manufacturer says, without decreasing efficiency or metallurgical characteristics, by the use of special refractories heretofore unobtainable.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution
Together with Trade Personals and Notes on Foreign Trade,
Jobbers' News and New Trade Literature

THE O. K. GIANT BATTERY COMPANY, Gary, Ind., is asking for bids for the construction of a one-story plant, 50 ft. x 400 ft., at West Gary, to cost about $60,000. The plans provide for the erection of ten other buildings of similar dimensions, which will make the total cost $660,000.

THE CENTRAL ELECTRIC & LOCK COMPANY, 12 North Thirteenth Street, Philadelphia, will remove its plant to 1309 Arch Street.

WILLIAM H. MATLACK, formerly assistant sales manager, has been appointed assistant to the president of the Bluebird Appliance Company, St. Louis, Mo.

THE ELECTRIC CONTROLLER & MANUFACTURING COMPANY, Cleveland, Ohio, has appointed M. D. Goodman manager of its new Boston office, which will soon be established at 49 Federal Street, Boston, Mass. Mr. Goodman has been connected with the New York sales office of the company.

THE BLAW-KNOX COMPANY, Pittsburgh, Pa., has issued Vol. I, No. 1, for April, and No. 2, for May, of its new magazine entitled *Blaw-Knox Life*.

THE WELLMAN-SEAVER-MORGAN COMPANY, Cleveland, Ohio, has elected John A. Penton, president of the Penton Publishing Company, director of the company to fill the vacancy on the board caused by the death of Samuel T. Wellman.

SLOCUM, AVRAM & SLOCUM LABORATORIES, Inc., 120 Pacific Street, Newark, N. J., announce the appointment of G. A. Unger as general "Flexite" sales agent and consulting engineer of its "Flexite" division.

THE MUELLER ELECTRIC COMPANY, Cleveland, Ohio, has moved its plant from 423-25 High Avenue to 2139-43 Fairmount Road, where it will occupy a two-story building. At the new location the company will have the necessary floor space for increased production of its line of battery clips, test clips and attachment plugs, and also for the manufacture of its new line of battery parts such as battery handles, terminals, etc.

THE AERO ALARM COMPANY, Seattle, Wash., is negotiating with the American District Telegraph Company of New York and Chicago to act as active agent for its products, covering 120 cities throughout the country. The Aero company will reserve New York, Boston, Philadelphia, Seattle and Spokane, where it has already established branches.

THE FEDERAL TRADE COMMISSION during the month of April served formal complaints on the Universal Motor Company, Oshkosh, Wis., and the Universal Products Company, Sandusky, Ohio, manufacturers of electric lighting plants, for "passing off of goods."

THE ESTERLINE COMPANY, Indianapolis, has appointed Ludwig Hommel & Company, Rose Building, Cleveland, Ohio, as exclusive representatives for that district. The Ludwig Hommel Company has for some time specialized in meter work. To cover the territory in eastern Pennsylvania, southern New Jersey, Maryland, Delaware and the District of Columbia, Linn O. Morrow of the Franklin Trust Company, Philadelphia, has been appointed for the Esterline Company. Mr. Morrow for a number of years has been connected with the sales department of The Cutter Company at Philadelphia and has been active in the technical affairs of the Association of Iron and Steel Electrical Engineers.

THE APEX ELECTRIC SPECIALTY COMPANY, 77 Orange Street, Newark, N. J., has filed notice of an increase in capital stock to $103,000 for general business expansion.

THE OTIS ELEVATOR COMPANY, New York, N. Y., is planning an extension to its foundry and forge shop and also improvements to existing buildings at its plant in Yonkers.

THE BENDER ELECTRIC COMPANY, 147 East State Street, Trenton, N. J., recently incorporated with a capital stock of $125,000, is considering the erection of a new building to cost about $25,000.

THE BUFFALO CHANDELIER COMPANY, Buffalo, N. Y., recently incorporated with a capital stock of $50,000, has acquired a building at Olak and Clinton Streets for its new plant.

WALKER AND PRATT TO MANUFACTURE ELECTRIC RANGES.—Electric ranges are to be placed on the market soon by the Walker & Pratt Manufacturing Company, 31 Union Street, Boston, Mass, following the establishment of a new department by this long-established house, known as the makers of the "Glenwood" coal and gas ranges. The company has been in business since 1865, when it was founded by George H. Walker, and the

ALBERT L. SMITH

factory at Watertown, Mass., is one of the largest and best equipped stove plants in the industry. Albert L. Smith has been appointed sales manager of the company. Mr. Smith is also vice-president of the Aetna Electric Appliance Company, with offices at 40 Court Street, Boston, Mass., and for the past three years has been Eastern representative of the Rathbone-Sard Electric Company. He has resigned from the latter post. Prior to becoming a manufacturer's representative, Mr. Smith was for a time head of the electric range division of the Edison Electric Illuminating Company of Boston.

THE BOSTON WOVEN WIRE BRUSH COMPANY, has moved its offices and works from Lynn, Mass., to Reading, Mass.

THE WORTHINGTON PUMP & MACHINERY COMPANY, 115 Broadway, New York City, announces that, in addition to the lines of hydraulic machinery which it has manufactured since 1840, it has now completed preparations to furnish improved water-power machinery of all capacities for low, medium and high-head service, including oil-pressure systems, waterwheel governors and other auxiliaries. It is entering this field equipped to produce hydraulic turbines to meet the highest standards in design, efficiency and workmanship.

P. T. BRADLEY has been appointed sales manager of the E. H. Freeman Electric Company, 803 East State Street, Trenton, N. J.

THE FRANK ADAM ELECTRIC COMPANY, St. Louis, Mo., announces the opening of its Pittsburgh office and warehouse at 7-9 West Canal Street, N. S., in charge of J. E. Mair, electrical engineer. Stocks will be carried for local distribution.

THE PACKARD ELECTRIC COMPANY, manufacturer of transformers and auto cables, has moved its Chicago office from 19 South Wells Street to Room 1207, Fisher Building, 343 South Dearborn Street.

THE McCLELLAN REFRIGERATING COMPANY, Chicago, has increased its manufacturing capacity so that the output of hotel, restaurant and meat-shop refrigerating machines can be doubled in a short time. By next November the company expects to have an additional daily output of fifty household refrigerating machines.

THE BOOTH ELECTRIC FURNACE COMPANY, Chicago, has announced the removal of its executive and sales offices in that city to the building occupied by the engineering and producton office at 326 West Madison Street, where adequate office space and facilities have been obtained to take care of all departments. B. G. Tarkington, formerly industrial heating engineer with the Hodenpyl-Hardy Company, Jackson, Mich., is now at the Chicago office in charge of district sales. The Buckeye Products Company, 919 West Fifth Street, Cincinnati, which has charge of sales in the Cincinnati territory, has placed D. E. Carpenter, formerly of the Detroit office of the Westinghouse Electric & Manufacturing Company, in charge of sales of Booth furnaces in that district. Among the foreign offices recently opened by the company is one at 321 Pitt Street, Sydney, Australia, in charge of Bartholomew Bannon.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., contemplates in the near future the erection of a factory building, 900 ft. x 100 ft., for the manufacture of small motors.

W. C. ROTT is now associated with Barton R. Shover, electrical, iron and steel plant and steam engineer, Oliver Building, Pittsburgh, Pa. Mr. Rott has been connected with the iron and steel business for the past fifteen years in the capacity of operator, designer and chief engineer.

THE TRIANGLE CONDUIT COMPANY, 50 Columbia Heights, Brooklyn, N. Y., has filed notice of an increase in capital stock from $30,000 to $100,000.

THE DEXTER WASHING MACHINE COMPANY, Fairfield, Iowa, is planning an addition to its plant, 80 ft. x 140 ft., to cost about $30,000.

THE DELTA-STAR ELECTRIC COMPANY, 2433-2453 Fulton Street, Chicago, has removed its Salt Lake City (Utah) office from the Walker Bank Building to 59 Broadway.

THE BLACK & DECKER COMPANY, Baltimore, Md., announces the removal of its Philadelphia branch office from the West End Trust Building to 318 North Broad Street. W. C. Allen is in charge. The Cleveland branch office has been removed from 6524 Euclid Avenue to 6225 Carnegie Avenue with G. A. Dodge in charge.

Supply Jobbers' Notes

THE BALTIMORE ELECTRICAL SUPPLY COMPANY, 309 North Calvert Street, Baltimore, Md., is planning to erect a new building, 69 ft. x 100 ft., to cost about $70,000, at 331-35 North Calvert Street.

L. E. TROTTER, assistant sales manager of the Post-Glover Electric Company, Cincinnati, Ohio, was elected a director at a recent stockholders' meeting of the company.

THE IOWA ELECTRICAL SUPPLY COMPANY, 203-7 Grand Avenue, Des Moines, Iowa, since the first of the year has extended its territory and has added three traveling salesmen to its force. C. E. Harding has recently been appointed purchasing agent of the company.

THE CONTINENTAL RADIO & ELECTRIC CORPORATION, 6 Warren Street, New York, recently incorporated, will engage in jobbing, dealing and retailing radio equipment and electrical supplies. The officers are: G. E. Burghard, president; John F. Grinan, vice-president; John Di Blasi, secretary, and Joseph Stantley, treasurer.

THE WESTERN ELECTRIC COMPANY is to build a $3,000,000 eleven-story concrete warehouse at 395 Hudson Street, New York City, 323 ft. x 340 ft., taking in the entire block. It is said that it will be the largest concrete building on Manhattan Island, and will be occupied jointly by the Western Electric Company and the New York Telephone Company.

Foreign Trade Notes

THE EUGENE F. PHILLIPS ELECTRICAL WORKS, LTD., Montreal, Can., is erecting an addition to its plant, to be used for the manufacture of enameled wire, in addition to its products of wire, cable, etc.

FOREIGN CREDIT INSURANCE EXCHANGE FORMED.—Announcement has been made of the organization of a mutual company for the insurance of credits in foreign countries, to be known as the American Manufacturers' Foreign Credit Insurance Exchange, Chamber of Commerce Building, Chicago. The purpose of this mutual exchange will be to supply adequate information on the financial status of foreign merchants and a reasonable safeguard in individual business transactions. The officers are: President, George R. Meyercord, president of the Meyercord Company, Chicago; treasurer, Samuel Hastings, president of the Computing Scale Company of America; secretary, John M. Glenn, secretary of the Illinois Manufacturers' Association. The general management is in charge of J. B. Benson, for many years sales and advertising executive with John and Joseph Drysdale & Company, Buenos Aires, Argentina, one of the largest importing houses in South America.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The manager of a cement factory in the Straits Settlements (No. 32,851) desires to purchase a 1,000-hp. turbo-generator unit and two water-tube boilers.

A firm in Canada (No. 32,858) desires to purchase electrical washing and drying outfits.

A manufacturing company in Switzerland (No. 32,816) desires to purchase large quantities of varnish for use on handles of electric flatirons. It must be black and capable of withstanding heat.

New Incorporations

THE FARM LIGHT CORPORATION OF VIRGINIA-CAROLINA, Norfolk, Va., has been incorporated with a capital stock of $25,000 to manufacture electric lighting systems. J. C. Gurley is president, and T. A. Pope is secretary.

THE SWANSEA (S. C.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $20,000. The officers are: C. L. Rast, president; C. L. Brooker, vice-president, and A. P. Jackson, secretary and treasurer.

THE VICTORY STORAGE BATTERY COMPANY, Maryland Casualty Building, Baltimore, Md., has been incorporated by A. J. Thompson, Edward B. Masterton and Henry Stockbridge. The company is capitalized at $319,000 and proposes to manufacture electric storage batteries for automobile service, etc.

THE PRESTO ELECTRIC COMPANY, New York, N. Y., has been chartered with a capital stock of $5,000 by F. Kaiser, M. Altschuler and M. M. Goldschmidt, 299 Broadway, New York City. The company proposes to manufacture electrical goods.

WATT & COMPANY, Johnson Building, Pineville, Ky., has been incorporated with a capital stock of $15,000 to manufacture electrical apparatus. The incorporators are P. E. Nuckols, R. M. Watt and N. R. Patterson.

THE GILLIAM LIGHT & MOTOR COMPANY, Union, S. C., has been incorporated by D. Fant and J. Louis Gilliam. The company is capitalized at $25,000 and proposes to manufacture isolated light and power plants, etc.

THE HOME LIGHT & POWER COMPANY has been chartered with a capital stock of $150,000 to manufacture electrical appliances, etc. The officers are: S. O. Lindeman, Richmond, president, and L. R. Lindeman, Raleigh, N. C., secretary.

THE MIDWAY ELECTRIC COMPANY, Shipsewana, Ind., has been incorporated with a capital stock of $25,000 to supply electricity for lamps and motors. The incorporators are Jonathan Farver, Frank Bevington and E. A. Wolfe.

THE SOMERSET (Va.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $65,000 to distribute electricity in Orange, Madison, Green and Louisa Counties. W. G. Buckner is president and D. F. Weaver is secretary.

Trade Publications

LAVA.—The American Lava Company, Chattanooga, Tenn., is issuing a booklet entitled "Lava," describing the use of lava for mechanical and electrical purposes.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York, N. Y., has issued bulletin No. 150, describing its type HA pocket portable ammeters, voltmeters and wattmeters for alternating current.

LIGHT FOR WORKSHOP.—Bulletin No. 85, issued by the Cooper Hewitt Electric Company, Hoboken, N. J., entitled "What Good Light Means To You," describes and illustrates the use of the Cooper Hewitt light in the workshop.

INSULATORS.—The R. Thomas & Sons Company, East Liverpool, Ohio, is distributing a fifteen-page booklet covering the Thomas Hewlett link-type insulator.

BELLS, BUZZERS AND SIGNAL GONGS.—Stanley & Patterson, West and Hubert Streets, New York, N. Y., has recently issued bulletin No. 31, in which it illustrates and describes its bells, buzzers and signal gongs, etc.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BRUNSWICK, ME.—Plans have been prepared for the construction of a new power plant by the Cabot Manufacturing Company, to be used in connection with the proposed new cotton mill, for which contract was recently awarded.

FORT KENT, ME.—The Fort Kent Electric Company contemplates the erection of a 33,000-volt transmission line to connect at Van Buren, Me., with the Maine & New Brunswick Electric Light & Power Company, a distance of 43 miles.

CHELSEA, MASS.—Bids will be received by Eli W. Hall, president for the trustees of the Soldiers' Home, Room 815, Kimball Building, Boston, until June 1, to construct and complete the addition to and the alteration of the power plant and new laundry building at the Soldiers' Home, Chelsea. Proposal blanks may be obtained at the office of the architect, Harrison H. Atwood, 61 Alban Street, Boston.

LOWELL, MASS.—Work has been started by Aberthaw Construction Company, 27 School Street, Boston, on the erection of a power house and manufacturing plant, to cost about $1,000,000, for the Lowell Weaving Company.

NEW BEDFORD, MASS.—The City Council has approved of changes in the lighting system on various streets of the city.

SPRINGFIELD, MASS.—The United Electric Light Company, 73 State Street, has awarded contract to the A. E. Stephens Company, 145 State Street, for the construction of a substation on North and Caren Streets, to cost about $100,000.

STAMFORD, CONN.—Plans of the Petroleum Heat & Power Company of Southfield Avenue include the erection of a foundry, for which estimates are now being received, and later the construction of a power house. The first unit of the plant is nearing completion.

Middle Atlantic States

ALBANY, N. Y.—The Consolidated Light & Power Company of Whitehall, N. Y., has applied for permission to erect transmission lines.

BUFFALO, N. Y.—The Niagara Machine & Tool Works, 633 Northland Avenue, are in the market for one 150-kw. motor-generator set to convert three-phase, 25-cycle, 2,000-volt alternating current to 230-volt direct current.

GENEVA, N. Y.—The Empire Gas & Electric Company contemplates improvements to its plant, including the installation of compressors, stokers, etc., to cost about $300,000.

GLENS FALLS, N. Y.—The Adirondack Electric Power Corporation contemplates the erection of an electric power plant in the vicinity of Cranesville. Negotiations are under way for a site for the plant.

LOCKPORT, N. Y.—Dumville & Company are in the market for a 3-hp., single-phase, 60-cycle, 110-volt, 1,200-r.p.m. motor.

NEW YORK, N. Y.—Contract has been awarded by the New York Edison Company to Clough Bourne, 101 Park Avenue, New York, for the construction of a three-story transformer station on East Sixth Street, to cost about $60,000.

WELLSVILLE, N. Y.—The village of Wellsville has voted on improvements to the municipal electric lighting plant, to cost about $35,000.

BUTLER, N. J.—Bids will soon be received for the construction of a municipal electric lighting plant, to cost between $50,000 and $60,000. Runyon & Carey, 845 Broad Street, Newark, N. J., are engineers.

GLEN RIDGE, N. J.—The installation of a "white-way" type street-lighting system on Bloomfield Avenue is under consideration.

HADDONFIELD, N. J.—Considerable electrical and mechanical equipment will be used in connection with the proposed new municipal disposal plant, to cost about $75,000.

JERSEY CITY, N. J.—Contract has been awarded by the American Butterine Company, 1 Montgomery Street, for the construction of a manufacturing building and power plant on Henderson Street, to cost about $100,000.

LAKEHURST, N. J.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the erection of a power house and a distribution system at the local navy yard.

NEWARK, N. J.—Arrangements have been completed for extensions to the "white-way" type street-lighting system on Park Place and Broad Street.

ALLENTOWN, PA.—The Phoenix Silk Manufacturing Company is having plans prepared for the erection of an addition to the power plant at its local silk mills. Carl A. Baer & Company, Land Title Building, Philadelphia, are engineers.

PHILADELPHIA, PA.—Frank Schoble & Company contemplates the erection of a power house, to have an initial capacity of about 1,200 hp., at its local works on Tenth and Oxford Streets.

CUMBERLAND, MD.—Kelly-Springfield Tire Company has awarded general contract for the erection of its rubber tire plant, to cost about $2,000,000, to the Hunkey-Conky Construction Company of Cleveland, Ohio. The Riggs, Distler & Stringer, Inc., 216 North Calvert Street, Baltimore, has received contract for furnishing and installing equipment for boiler house, power house, pumping station and main factory building, to include 8,000-hp. boilers and two 5,000-kw. turbine generating sets.

LANSDOWNE, MD.—Bids will be received by P. C. Walsh, 3d, manager, 295 Passaic Street, Newark, N. J., until June 10, for the construction of a steel rolling mill for the National Steel Rolling Company, 203 Keyser Building, Baltimore, Md., to cost $100,000, including equipment. Electric motors will be installed.

MASSEY, MD.—The erection of an electric light plant is under consideration by the town officials.

FAIRMONT, W. VA.—Property of the Amos Coal Company has been acquired by M. R. Beerbower and others, who are planning to electrify the works and install considerable equipment.

WHEELING, W. VA. — The Wheeling Electric Company has completed plans to establish a new power loop to run through Fulton at Rudler's, where a substation will be erected, and continue on a straight line north to Windsor. The substation will supply the suburban district.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer of the army, Washington, D. C., until June 5, Proposal 3635-126CP, for furnishing 17,000 fuses. Further information may be obtained at the above address.

North Central States

CANTON, OHIO.—Bonds to the amount of $750,000 have been voted for the erection of a high school, to be known as the John H. Lehman School. Thayer & Thayer, Mercantile Building, New Castle, Pa., are architects.

CLEVELAND, OHIO.—The City Council has authorized a bond issue of $500,000 for the maintenance and necessary extensions along lines in territory served by the city. A similar amount, to be issued in the fall, will be asked for extensions into new territory.

CLEVELAND, OHIO.—The erection of two electric transmitting stations, one at West 103d Street and Western Avenue, and the other near Euclid Avenue and East 105th Street, is contemplated, at a cost of about $100,000 each. W. E. Davis, City Hall, is engineer.

EAST CLEVELAND, OHIO.—The East Cleveland Hospital Commission has had plans prepared by A. M. Allen & Company, 1900 Euclid Avenue, Cleveland, engineers, for the erection of a hospital, to cost about $600,000. Plans provide for electric lighting equipment and the installation of an electric elevator.

LODI, OHIO.—The Lodi Light & Power Company, recently organized, has taken over the local electric light plant and contemplates rebuilding the distribution system and the installation of a rotary converter to convert 25-cycle energy into 60-cycle.

MANSFIELD, OHIO.—The Kenny Foundry Company is planning the construction of a power house, foundry, etc.

MOUNT VERNON, OHIO.—The installation of a municipal electric power plant is under consideration. At present energy for street-lighting and driving pumps is supplied by the Ohio Power Company.

LOTHAIR, KY.—The Kentucky & West Virginia Power Company, Land Title Building, Philadelphia, Pa., plans extensive improvements, to include the extension of its 33,000-volt transmission lines to Yellow Creek, in Knott County, 6,600-volt lines from Blackey to Ulvah, Ky., etc. F. R. Weller, Washington, D. C., is consulting engineer.

PADUCAH, KY.—A local site has been acquired by the Southern Textile & Machinery Company, 433 South Third Street, for the erection of its new works. Plans for the first unit include construction of a power house.

INDIANAPOLIS, IND.—On petition of Virginia Avenue business men, the board of public works has ordered electric light standards placed on both sides of the Avenue from Washington Street to East Street.

TERRE HAUTE, IND.—Permission has been granted the American Car & Foundry Company to erect a brick and steel power house at its plant at Tenth and Crawford Streets, to replace the building destroyed by fire last fall. The cost is estimated at about $20,000.

WASHINGTON, IND.—The City Council has authorized the construction of a municipal electric light and power plant at East Side Park, to cost about $115,000.

NEWTON, ILL.—Bids will be received by Fuller Beard, engineer, Chemical Building, St. Louis, Mo., until June 15, for extensions to the electric light plant and waterworks and improvements to the pumping station, to cost about $50,000.

STERLING, ILL. — Request has been made by the Sterling Association of Commerce that the City Council consider extensions to the boulevard lighting system.

OSHKOSH, WIS.—Work has been started on the construction of a new plant for the Oshkosh Motor Truck Company. The first building consists of a machine shop and assembling floor, 102 ft. x 410 ft. An office building and transformer house will also be erected.

PESHTIGO, WIS.—The Peshtigo Pulp & Paper Company has applied to the Wisconsin Railroad Commission for permission to construct a dam at Potato Rapids, on the Peshtigo River, for power purposes, in connection with the operation of a new sulphite plant which the company plans to erect at Peshtigo, and also to operate the present paper mill.

PORT WING, WIS.—A company is being organized by T. N. Okerstrom of Port Wing and others for the purpose of constructing a hydro-electric power plant and a dam across Iron River, to cost about $200,000. J. C. Jacobson, 533 Metropolitan Bank Building, Minneapolis, Minn., is engineer.

BUFFALO, MINN.—Bids will be received by B. A. Bonstrum, village clerk, until June 4, for equipment, including two pumps and motors, one auto-starter for pumps, etc., in connection with the establishment of the deep well and water system in the village. The estimated cost of the project is about $60,000.

ST. LOUIS, MO.—Bonds to the amount of $1,000,000 have been voted to establish a new street-lighting system.

MOBRIDGE, S. D.—The construction of a hydro-electric plant at Mobridge on the Missouri River is under consideration. Plans also include erection of transmission systems, estimated at $1,000,000 and $7,000,000.

LOUP CITY, NEB.—Separate bids will be received by the county clerk of Sherman County until June 27 for the erection and completion of court house, heating and plumbing, electric wiring, electric fixtures, etc. Plans and specifications are on file with the county clerk and with the Henningson Engineering Company of Omaha.

CALLISON, KAN.—Bonds to the amount of $15,000 have been voted for the erection of a transmission line from Callison to Pratt, a distance of 9 miles. W. B. Rollins & Company, 209 Railway Exchange Building, Kansas City, Mo., are engineers.

Southern States

YOUNGSVILLE, N. C.—The construction of a municipal electric lighting station, to cost about $20,000, is contemplated. J. R. Pearce is mayor.

ANDERSON, S. C.—Improvements to the electric light and water systems in the mill village, to cost about $75,000, are contemplated by the Equinox Mills.

NEWBERRY, S. C.—Bonds to the amount of $18,000 have been voted for the installation of a municipal electric light plant. E. S. Blease is Mayor.

ADEL, GA.—Bonds to the amount of $12,000 have been voted for improvements to the electric light and waterworks system.

BAINBRIDGE, GA. — The Bainbridge Power Company has awarded contracts to A. Dallam O'Brien, 1641 Amelia Street, New Orleans, La., for the construction of a power house and a dam in connection with the proposed water-power development on Spring Creek. The cost of the project is estimated at about $75,000.

MADISON, GA.—Improvements to the electric light and water plant are under consideration. R. W. Parker is Mayor.

SANDERSVILLE, GA. — Bonds to the amount of $40,000 have been voted for proposed city improvements, to include rebuilding the light plant.

SOPERTON, GA.—Bonds to the amount of $10,000 have been submitted to the voters for the installation of a municipal electric light plant.

FORT PIERCE, FLA.—Additions to the municipal electric light and water plant are under consideration.

TALLAHASSEE, FLA.—Bonds to the amount of $175,000 have been authorized for the installation of electric light, gas and water plants.

KNOXVILLE, TENN.—The board of managers is having plans prepared for the construction of a new power plant and laundry building at the Fort Sanders Hospital.

MEMPHIS, TENN.—Receivers of the Memphis Gas & Electric Company have been granted a permit for the construction of a booster substation at the west end of Elzey Place, to cost about $25,000. Other improvements are contemplated by the company. J. F. Ramier is general manager.

FORT SMITH, ARK.—The plant of the Fort Smith Light & Traction Company, it is reported, has been destroyed by fire, causing a loss of about $10,000.

LITTLE ROCK, ARK.—E. L. Bruce & Company is in the market for a new or used 25-hp., three-phase, 60-cycle, 440-volt motor.

MINDEN, LA.—Bonds to the amount of $20,000 have been voted for improvements to the electric light plant. George S. Carroll is Mayor.

BEAUMONT, TEX.—Arrangements have been made by the Eastern Texas Electric Company for a bond issue of $1,500,000, of which a part will be expended for improvements to its plant, including the installation of a 4,000-kw. turbo-generator. C. F. W. Wetterer is president.

DALLAS, TEX.—The construction of an electric interurban railway from Dallas to Wichita Falls, a distance of 143 miles, is contemplated by a committee of Dallas citizens and the General Electric Company. Wiley Blair, of Dallas, is chairman of the committee.

DALLAS, TEX.—Bids will soon be asked by Martin C. Schwab, engineer, 30 North Michigan Boulevard, Chicago, Ill., for electric wiring of the merchandise building to be erected by Sears, Roebuck & Company, Arlington and Homan Avenues, Chicago, Ill., at a cost of about $2,000,000. George C. Nimmons & Company, 120 South Michigan Avenue, Chicago, are architects.

HOUSTON, TEX.—The city officials plan to construct a power house, barn, and improve shops; also install block signals and erect feed lines. Total cost is estimated at about $97,600.

HOUSTON, TEX.—The Houston Lighting & Power Company contemplates the erection of a 2,300-volt primary service line to West University Place. Cost is estimated at about $10,000.

TOYAH, TEX.—The City Council has granted a franchise to Jesse Knight for the construction and operation of an electric light and power plant in this locality.

VERNON, TEX.—Investigation is being made as to the necessity of an expenditure of $100,000 by the Texas Public Service Company for additions to its electric light and power plant. A. V. Foster is president of the Public Service Company.

Pacific and Mountain States

CENTRALIA, WASH.—The Kane Pneumatic Shock Absorber Company have had plans prepared for the immediate erection of a 750-kw. to 1,500-kw. power plant at Fords Prairie. Peter W. Kane is president of the company.

OLYMPIA, WASH.—Contract has been awarded to Albertson, Cornell Brothers & Simpson, Tacoma, for the construction of power and heating plants for the State Capitol group of buildings, at a cost of $155,263.

SEATTLE, WASH.—An ordinance authorizing an appropriation of $495,000 to complete the construction of a pipe line and the installation of a 15,000-kw. generating unit at the Cedar Falls plant has been passed. An ordinance appropriating $511,000 to complete the installation of a 15,000-kw. generating unit at the Lake Union steam plant has been referred to the Public Utilities Commission.

EL SEGUNDO, CAL. — The General Chemical Company, 25 Broad Street, New York, N. Y., has awarded contract to the J. G. White Engineering Corporation, 43 Exchange Place, New York, for the construction of a group of factory buildings here, to cost about $2,000,000.

LONG BEACH, CAL.—The Pacific Telephone Company plans to enlarge and improve its quarters, having leased the entire Giddings building. New equipment will be installed.

LOS ANGELES, CAL.—The Board of Public Service has authorized the purchase of two motors for the San Fernando unit of the aqueduct power system and one for the Franklin Canyon unit, to cost about $200,000. This installation gives the city an additional 10,000 hp.

MONTECITO, CAL.—The Santa Barbara Telephone Company has authorized the erection of a telephone exchange building and the installation of modern telephone equipment.

REDDING, CAL.—Pacific Gas & Electric Company plans an expenditure of over $3,000,000 on electrical developments in Shasta County, this season. The first items of construction will be two power houses in Hat Creek Valley, each developing 10,000 hp., and the erection of a pole line from the power plants to Cottonwood.

SUSANVILLE, CAL.—The State Railroad Commission has granted the Lassen Electric Company permission to issue $100,000 in bonds, of which $64,000 will be used for the erection of a 25-mile transmission line from Susanville to Westwood, to carry electric energy which the company proposes to purchase from the Red River Lumber Company.

ORDWAY, COLO.—The installation of an ornamental street-lighting system in District 1, is planned. J. B. Estes is clerk.

Canada

BRAMPTON, ONT.—Bids are being received by W. Treadgold of Brampton for furnishing and delivering a turbine pump with electric motor, rated at about 500 gal. per minute.

CHELSEY, ONT.—W. G. Durst desires to purchase 2, 3, 5, 10 and 15-hp. electric motors, three-phase, alternating current, 220 volts.

ELK LAKE, ONT.—W. H. Seamon, manager of the Matachewan Gold Mines, is considering the installation of a 100-ton crushing mill, to be electrically operated. The cost is estimated at about $50,000.

GRAND BEND, ONT.—A bylaw authorizing the installation of a hydro-electric system, will soon be submitted to the ratepayers. Henry Eilber, Crediton, Ont., is clerk.

PETERSBORO, ONT. — The Canadian General Electric Company has awarded contract to John E. Hayes, 219 Park Street, for the construction of a factory, to cost about $500,000.

TORONTO, ONT.—Plans are being prepared by the H. M. Lane Company, engineers, Windsor, Ont., for the construction of a machine shop, 52 ft. x 180 ft., for the Grinnell Company. Electric lighting equipment and electric motors will be installed.

DANVILLE, QUE.—Plans are underway for the erection of an electric light plant in Danville. Mr. Brown is secretary-treasurer.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until June 12, Circular 1371, for furnishing electric welding outfit, vacuum exhaust outfit, steel, electric bells, marine connecting boxes, copper cable, conduit cutting tool, fiber conduit, condulets, cut-outs, electric fans, signal lantern, motor, lighting projectors, lead sleeving, transformers, etc.

PETERSBURG, ALASKA—Bonds have been authorized for the erection of an electric light and water plant. The development of a water power system is also contemplated.

Record of Electrical Patents

Notes on United States Patents

(Issued April 27, 1920)

1,338,324. IGNITION AND LIGHTING DEVICE; Alfons H. Neuland, San Francisco, Cal. App. filed Sept. 6, 1916. Combines advantages of both battery and magneto ignition.

1,338,328. CLOCK SYSTEM; Arthur F. Poole, Chicago, Ill. App. filed Sept. 10, 1917. Used with commercial alternating-current distribution systems.

1,338,333. CONTROL SYSTEM; Karl A. Simmon, Edgewood Park, Pa. App. filed Sept. 21, 1916. Electric vehicle motors operated through a number of resistance and field control positions when connected in series and in parallel relation.

1,338,334. CIRCUIT INTERRUPTER; Joseph Slepian, Pittsburgh, Pa. App. filed Jan. 14, 1918. Dissipates electromagnetic energy of circuit when interrupter is opened.

1,338,350. TELEPHONE SYSTEM; William Aitken, London, Eng. App. filed March 20, 1917. Connecting means for each subscriber's line so that connection can be obtained with one of a number of different outgoing and incoming lines.

1,338,352. ELECTRICAL PROCESS AND APPARATUS FOR COMPOUNDING LIQUIDS WITH GASES OR OTHER COMPONENTS AND THE PRODUCTS THEREOF, INCLUDING CARBONATING BEVERAGES; Jacob E. Bloom, Brooklyn, N. Y. App. filed Sept. 30, 1919. Compounding by electric attractive forces or stress including electric absorption.

1,338,353. ELECTRICAL PROCESS AND APPARATUS FOR THE DYEING OF FURS AND OTHER MATERIALS AND THE PRODUCTS RESULTING THEREFROM; Jacob E. Bloom, Brooklyn, N. Y. App. filed Sept. 30, 1919. Fastening of dyestuffs on hair or fur by electrical absorption.

1,338,359. ELECTRIC SINGEING FURNACE; Ora A. Colby, Larimer, Pa. App. filed Oct. 30, 1918. Uniform singeing of cloth.

1,338,367. SINGLE-PHASE MOTOR-CONTROL SYSTEM; Rudolf E. Hellmund, Swissvale, Pa. App. filed Oct. 3, 1917. Manual or automatic control of speed and power factor dependent upon load applied to motor.

1,338,368. SYSTEM OF CONTROL FOR ALTERNATING-CURRENT COMMUTATOR MOTORS; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 28, 1917. Permits not only control of speed and of power factor but also of degree of compensation to insure proper commutation for various conditions of load on motor.

1,338,370. AUTOMATIC TELEPHONE SYSTEM; Harry E. Hershey, Whitewater, Kan. App. filed March 10, 1916. Single group of connector switches for each group of polystation lines.

1,338,380. VIBRATORY CONVERTER; Oscar M. Leich, Genoa, Ill. App. filed Oct. 31, 1918. Telegraph sounders supplied from a common source of unidirectional pulsatory current obtained from an alternating-current source of supply.

1,338,408. CONTROL SYSTEM FOR ELECTRIC FURNACES; Frank Thornton, Jr., Mansfield, Ohio. App. filed June 29, 1918. Automatically varies current supplied to furnace in accordance with variations in temperature.

1,338,412. PRIMARY BATTERY; Charles A. Xardell, Utica, N. Y. App. filed March 13, 1919. Current capacity of relatively high voltage for a given size of battery for all practical purposes non-polarizing.

1,338,439. METALLURGICAL METHOD AND APPARATUS; Guyon F. Greenwood, Georgeville, Quebec, Canada. App. filed July 19, 1918. System for roasting, reducing and refining oxide, carbonate and other ores.

1,338,440. PRODUCTION OF LEAD; Guyon F. Greenwood, Georgeville, Quebec, Canada. App. filed July 23, 1918. Electric heating element in drum for roasting sulphide ores.

1,338,465. GALVANIC BATTERY; Roscoe J. Smith, Newark, N. J. App. filed Dec. 22, 1915. Battery cell of considerable weight quickly moved and lifted without imposing undue strains on cells.

1,338,492. ART OR METHOD OF PRODUCING PHOTOGRAPHIC SCREENS FOR HALFTONE WORK; Harry A. Corbett, New York, N. Y. App. filed March 28, 1916. Master plate quickly and accurately duplicated.

1,338,497. TELEGRAPH INSTRUMENT; Thomas J. Dunn, Jersey City, N. J. App. filed March 22, 1917. Sending devices for transmitting messages by element vertically upstanding from base and vibrating about one end as a center.

1,338,521. IGNITION DETECTOR AND SPARK INTENSIFIER; Alexander Q. Nash, Kansas City, Mo. App. filed April 26, 1918. Indicates condition of controlling circuits for gasolene engine.

1,338,523. ADVERTISING APPARATUS; Jacon R. Osborne, Clinton, Mo. App. filed Aug. 23, 1917. Advances web and controls its movements to a predetermined point.

1,338,548. ELECTROMAGNET; Charles E. Avery, Trenton, N. J. App. filed March 27, 1917. Eliminates chatter of armature and secures an increased range of movement.

1,338,568. ELECTRIC MOTOR; Leonard Foote, Pedro Miguel, Canal Zone, Panama. App. filed Nov. 4, 1918. Large number of poles provided within a small space for low-speed motor the field structure of which is applicable to both alternating-current and direct-current motors.

1,338,611. ELECTRICALLY HEATED DRAFT DEVICE; Warren A. Brown, Hempstead, N. Y. App. filed Jan. 6, 1919. Toy of revolving type operated by a draft or current of air.

1,338,631. ELECTRIC FURNACE; Jonas Herlenius, Brooklyn, N. Y. App. filed Feb. 8, 1918. Aperture through which electrode projects into furnace sealed against air leakage.

(Issued May 4, 1920)

1,338,690. BATTERY BOX; Thomas L. Moorman, Farmville, Va. App. filed Feb. 27, 1920. Protective casing for battery on Ford cars.

1,338,717. PROCESS OF MAKING ELECTRICAL RESISTANCE UNITS; Charles Wirt, Philadelphia, Pa. App. filed Oct. 22, 1918. High resistance in proportion to its size.

1,338,718. REGULATING SYSTEM; Walter R. Woodward, Wilkinsburg, Pa. App. filed July 11, 1916. Combination of current transformers of different characteristics used with an automatic regulator.

1,338,734. MINERAL-MANURE PROCESS; Woolsey McA. Johnson, Hartford, Conn. App. filed Feb. 2, 1915. Commercial process for utilizing feldspar in production of mineral manures by electric furnace.

1,338,756. RECEIVER FOR WIRELESS TELEGRAPH AND TELEPHONE CIRCUITS; Frank E. Summers, Memphis, Mo. App. filed April 28, 1916. Weak impulses from distant sending stations are amplified, so that the transmitted signals will be increased in intensity.

1,338,758. IMPULSE STARTING MECHANISM AND METHOD OF OPERATING THE SAME; Max Tost, Detroit, Mich. App. filed Jan. 2, 1918. Impelling spring restressed without turning the driving unit for that purpose.

1,338,762. ELECTRICAL WELDING MACHINE; Edwin M. Bassler, Milwaukee, Wis. App. filed Oct. 6, 1919. For butt welding rods, bars, pipes and tubes, the pieces being forced together by hand or foot power applied by the machine operator.

1,338,812. ELECTROTHERAPEUTIC APPARATUS; Wendell L. Carlson and Earl C. Hanson, Washington, D. C. App. filed July 12, 1919. Frequency currents for imparting beneficial effects to the body.

1,338,857. ENGINE-STARTING AND AUTOMOBILE-LIGHTING SYSTEM; Justus B. Entz, Cleveland, Ohio. App. filed March 11, 1912. Motor in starting engine has high starting torque and when driven by the engine serves at varying speed as a constant potential generator.

1,338,881. PRODUCTION OF IRON IN AN ELECTRIC FURNACE; Guy J. Stock, Bradford, Eng. App. filed Feb. 13, 1920. Endothermic chemical reaction results in conversion of ore to metallic iron and subsequent melting of reduced metallic iron.

1,338,884. TRANSFORMER; Chester H. Thordarson, Chicago, Ill. App. filed Dec. 8, 1913. Separately wound winding sections spaced to insulate winding sections one from the other and to provide ventilating passages so that all turns of each section are exposed on opposite sides of section to action of cooling medium.

1,338,888. METHOD OF MAKING THERMOPHONES; Anthonius M. Van Doorn, Newton, Mass. App. filed March 21, 1919. Number of wires form loops between points of attachment to electrodes, being made by Wollaston process with a platinum core and a silver coating.

1,338,889. APPARATUS FOR RADIOSIGNALING; Roy A. Weagant, Roselle, N. J. App. filed Feb. 1, 1916. Cold element connected with indicator and a point upon filament.

1,338,952. APPARATUS FOR REGULATING THE STRENGTH OF ELECTRIC CURRENTS FOR MEDICAL PURPOSES; Minos Nicoletis, Paris, France. App. filed July 17, 1918. Clock-driven mechanism for periodically and automatically varying resistance.

1,338,984. COMBINED WAVE CHANGER AND WAVE METER; Guy Hill, Washington, D. C. App. filed Oct. 7, 1918. For determining wave lengths and for simultaneously adjusting both wave changer and wave meter.